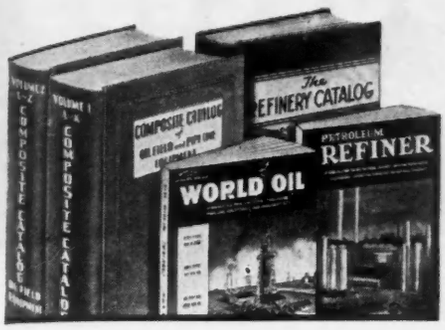


Specialized Oil Publications of
THE GULF PUBLISHING COMPANY
Box 2608, Houston (1), Texas

WORLD OIL and The COMPOSITE CATALOG
for the drilling-producing-pipe line industry

PETROLEUM REFINER and The REFINERY CATALOG
for the refining-natural gasoline industry

RAY L. DUDLEY, *President, Publisher*
A. L. BURNS, *General Manager*

EDITORIAL STAFF

WARREN L. BAKER, *Editor*
AL REESE, *Managing Editor*
L. J. LOGAN, *Associate Editor*
ELTON STERRETT, *Engineering Editor*
GEORGE O. IVES, *International Editor*
J. E. KASTROP — CECIL SMITH
MARY E. POOLE, *Librarian*
3301 Buffalo Drive, Houston 6, Texas

HENRY OZANNE
250 Park Ave.
New York 17, N. Y.

GILBERT M. WILSON
W. W. Wilson Bldg.
Huntington Park, Calif.

ANTHONY GIBBON
Hunt Bldg.
Tulsa 3, Okla.

E. N. TIRATSOO
15 Redcliffe Gardens,
SW 10, London

ADVERTISING STAFF

TOM W. NELSON, *Advertising Manager*
RANDALL BROOKS, *Assistant Advertising Manager*

NELSON BIGELOW
FRANK VICKREY
250 Park Ave.
New York 17, N. Y.

ROGER MOTHERAL
1010 Euclid Ave.
Cleveland 15, Ohio

H. G. FITZPATRICK
332 S. Michigan Ave.
Chicago 4, Ill.

BILL ATCHESON
Hunt Bldg.
Tulsa 3, Okla.

J. W. CURTS
W. W. Wilson Bldg.
Huntington Park, Calif.

CHARLES WYATT
3301 Buffalo Drive
Houston 6, Texas

CIRCULATION DEPARTMENT

CLINTON S. QUIN, JR., *Manager*

Published every month except semi-monthly in February. Single copies 50 cents (except special issues). Subscription price: domestic and foreign, $2 a year; 2 years, $3; 3 years, $4. Advertising rates on application. Copyright, 1948, by The Gulf Publishing Company.

If You
ARE NOT A SUBSCRIBER IN YOUR OWN NAME TO WORLD OIL . . .
Join more than 18,000 people in the drilling, producing, pipe line industry who say "Keep my WORLD OIL coming." Use the personal order blank on page 278.

ABC WORLD OIL HBP
Established 1916 as THE OIL WEEKLY

CONTENTS

October, 1948 **Vol. 128, No. 6**

NEWS ANALYSIS SECTION

The Changing Panorama ... 29
Publisher's Page — *Ray L. Dudley* ... 31
Monthly News Analysis ... 33
Looking Ahead ... 42

CURRENT OUTLOOK SECTION

Midland Basin Oil Possibilities — *H. H. King* ... 45
Drilling Prices Fail to Keep Pace with Rising Costs — *Warren L. Baker* ... 52
The Price of Natural Gas as a Conservation Factor — *Walker T. Pound* ... 54
New Oil-Using Units Enlarge Petroleum Demand ... 58
The Economic Equation of Public and Labor Relations — *Karl L. Elliot* ... 61
Stanolind Collects Safety Dividends — *Anthony Gibbon* ... 62
Refined Products Stocks In Fairly Good Condition ... 64
Completions Reach New High of 3820 ... 66
Exploration Results in Three New Fields — *Cecil Smith* ... 69

DRILLING SECTION

Causes and Prevention of Drill Pipe and Tool Joint Troubles (First of Six Parts)
H. G. Texter and R. S. Grant (Revised by H. G. Texter and S. C. Moore) ... 79
The Relation of Nozzle Fluid Velocity to Rate of Penetration with Drag-Type Rotary Bits (Last of Two Parts)
J. P. Nolley, George E. Cannon, and Douglas Ragland ... 87
Compounded Power Pumps Drill to 10,000 Feet ... 96
Drilling with Industrial Diamonds — *Karl J. Klapka* ... 98
How to Do It—Drilling Hints ... 108
Cotton County, Poor Boy's Paradise — *James D. Pate* ... 122

PRODUCTION SECTION

Combination Unit Speeds Workovers — *Gilbert M. Wilson* ... 129
Chemical Removal of Aluminum Pipe Sections — *C. E. Clason* ... 132
Cost Study of a Waterflood Development in Bradford, Penn.
J. K. Barton and R. G. Prentice ... 134
A Study of Gun Perforating (Part 3, Conclusion) — *Val L. Forsyth* ... 142
Present Day Aspects of High Pressure Well Equipment Corrosion
W. F. Rogers ... 154
Gas Storage in Water Sand Reservoir at Hastings ... 162
How to Do It—Production Hints ... 166

PIPE LINE SECTION

Automatic Control of Natural Gas Lines — *W. A. Brewster* ... 179
High Speed Pump Operation — *F. V. Cook* ... 187
Invasion Pipe Solves Cuyama Line Problem — *Gilbert M. Wilson* ... 190
Cooperative Refinery Association and Cooperative Pipe Line Association's Pipe Line System (55th of a Series) ... 195
Pipe Line Construction ... 196
How to Do It—Pipe Line Hints ... 203

INTERNATIONAL SECTION

Directional Hole Tames Canadian Wild Well — *Gordon B. Nicholson* ... 213
Ras El Misha'ab—Arabian Desert Camp ... 217
Future of Colombia's De Mares Concession — *George O. Ives* ... 222
Emsland Area Center of Dutch-German Dispute ... 226
Co-Ops Enter International Field ... 229
Discovery Spurs Mexico Exploration ... 230
Production Up in Persian Gulf Area ... 234
Production Gains Reported in Brazil and Egypt ... 236
Rio Ule Pipe Line to Deliver First Crude on December 1 ... 238
Egypt's Production in 1948 May Exceed 1947 Output ... 242

OTHER DEPARTMENTS

New and Improved Equipment ... 245
Other New Equipment ... 256
New Literature ... 264
Associations ... 266
The Oil Man's Calendar ... 274
Men in the Industry News ... 276
Equipment and Service Suppliers' Notes ... 290
New Books ... 303
Squeaks from the Bullwheel ... 304
Advertisers' Index ... 24

FOR CEMENTING SUCCESS

Use the BAKER Cement Wash-Down *Whirler* Float Shoe

(Product No. 120)

A SEAMLESS STEEL SHOE in which a strong concrete plug and plastic valve assembly are securely anchored.

ACCURATELY CUT THREADS to fit any style casing.

A PLASTIC BALL VALVE to seal instantly against a resilient valve seat.

BAKER-FORMULA CONCRETE and *granular* plastic; easily drillable.

WASH-DOWN *Whirler* PORTS whirl cement slurry to provide uniform encirclement of casing with cement.

AMPLE CIRCULATING PASSAGEWAYS for hole conditioning and cementing.

Whirling action, plus jetting action, removes bridges and conditions the hole.

Whirling action reduces hazards of channeling.

YOU WILL FIND *ALL* THESE FEATURES *ONLY* IN THE

BAKER

CEMENT WASH-DOWN *Whirler* FLOAT SHOE

The Changing Panorama

Deep Drilling Rigs Radically Improved

FUTURE RIGS for drilling deeper wells doubtless will embody radical improvements which already are being employed on a pioneering "super rig" of Humble Oil & Refining Company on the Texas Gulf Coast. The rig minimizes physical exertion of crew members, who operate machinery that does the hard work involved. Hydraulic tongs and mechanical racking arms at top and bottom of derrick make handling of drill pipe easy. Automatic, electronic drilling control assures correct weight on drill bit, speeds drilling, and avoids twist-offs. Other features are improved mud mixer, high-fluid-velocity bits, drilling rate meter, and pneumatic throttles for finger-tip control of hoisting engine, mud pumps, and rotary speed governor.

This improved rig, being used for 10,000-foot drilling in the Sugar Valley field, is described and pictured in a six-page article in the July-August, 1948, issue of "The Humble Way," Humble company magazine. Pneumatic control in drilling mud system was described and illustrated in WORLD OIL (September, 1948, page 71).

Secondary Recovery Reserves Are Large

KNOWN ACCUMULATIONS of oil in the U. S. recoverable by secondary recovery methods represent a comparatively large proved reserve, more than one-fifth as great as the present proved reserve recoverable by primary methods.

Paul D. Torrey, chairman of the secondary recovery advisory committee of the Interstate Oil Compact Commission, recently presented by letter to members of the committee a preliminary evaluation of secondary recovery reserves indicating that they are potentially quite important. Torrey pointed out that authoritative estimators have placed the secondary recovery reserves of the five states, Illinois, Oklahoma, Arkansas, New York, and Pennsylvania, and of West Texas at a figure in excess of 5 billion barrels. In addition, he stated, it is quite possible that one-half billion barrels should be recovered in Colorado and Montana.

Reserves of such magnitude naturally promote interest in their recovery, and the industry doubtless will find very valuable the report on these reserves to be prepared by the Interstate Oil Compact Commission on the basis of the studies now under way under its sponsorship.

Steel for Oil Short Though Output Large

LESS THAN 50 YEARS ago petroleum supplied only 8 percent of U. S. total energy; today, almost half the energy is derived from petroleum and natural gas, and their use is increasing daily.

Especially important in swelling oil consumption in recent years has been the remarkable expansion of agricultural use. There are more than 3 million tractors now in use in American agriculture, and each tractor, on an average, operates five tools. Today there are 9000 farm airplanes, an increase of 8900 percent since 1941.

Although none were used in 1941, by 1947 there were 10,000 self-propelled combines in operation on American farms. These machines constitute one of the many innovations made during the war years that have caused the farm to become a major factor in today's ever growing use of oil.

Today, 80 percent of the nation's farm lands is plowed by tractors. In the cases of wheat, oats and other small grains, 90 percent of the seeding and harvesting is done with oil-powered equipment. Incidentally, the horse and mule population of American farms has declined steadily since 1935, while the number of tractors has increased 186 percent since that year.

More than 4.2 billion man-hours are saved yearly on American farms because of mechanization, and today, thanks to the benefits of oil in agriculture, the average American farmer can grow enough produce to support himself and 14 other persons.

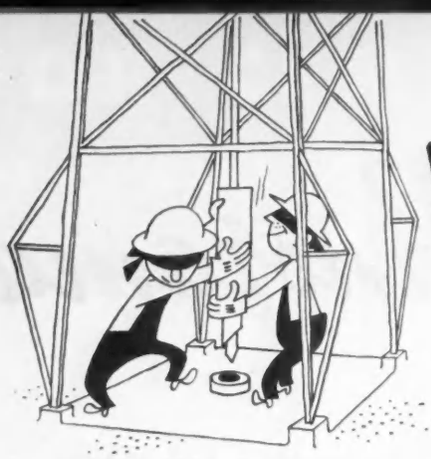
Farm Use Important In High Oil Demand

A PROGRAM for voluntary allocation of steel for the oil field tank and production equipment industry has been approved by Commerce Secretary Sawyer and has been cleared by Attorney General Clark. The plan, which has been submitted by the Office of Industry Cooperation to all steel producers and equipment manufacturers; calls for 16,530 tons of steel products a month, beginning October, 1948, and continuing through February, 1949, for use in construction of all necessary appliances for oil and gas production at the wellhead.

However, plans for a voluntary allocation of steel to pipe mills were doomed when Secretary Sawyer rejected Interior Secretary Krug's suggestion that the steel industry again be asked to undertake such an allocation program. Steel officials twice previously refused to approve any program for allocation of tubular goods and line pipe.

Meanwhile, steel production has gone to a record peak. The August output of 7,417,599 net tons of ingots raised the 1948 production to date to 57,533,535 tons, the American Iron and Steel Institute has reported. The August output was 426,447 net tons in excess of the corresponding month last year and forecasts a total 1948 output of 87 million tons as against the previous high of 84,894,071 tons for 1947.

The steel industry points out that even this record production hardly promises to meet demand of end users, especially in the face of steadily rising amounts necessary to carry voluntary allocation programs already approved. Total steel allocation in the fourth quarter this year is expected to run about 10 percent of all steel shipments. The difficulty is stressed when the allocation figures are broken down to specific levels—more than one-third of plate shipments for the last quarter of 1948 are earmarked for allocation; more than 20 percent of structural steel output is so earmarked. In general, the steel industry holds that extension of the allocation programs might soon disrupt normal general distribution patterns.



Working in the dark?

You don't have to play blind man's buff when you're looking for added production.

Dowell Service Engineers are ACIDIZING EXPERTS

You get the best when you call in Dowell for acidizing service.

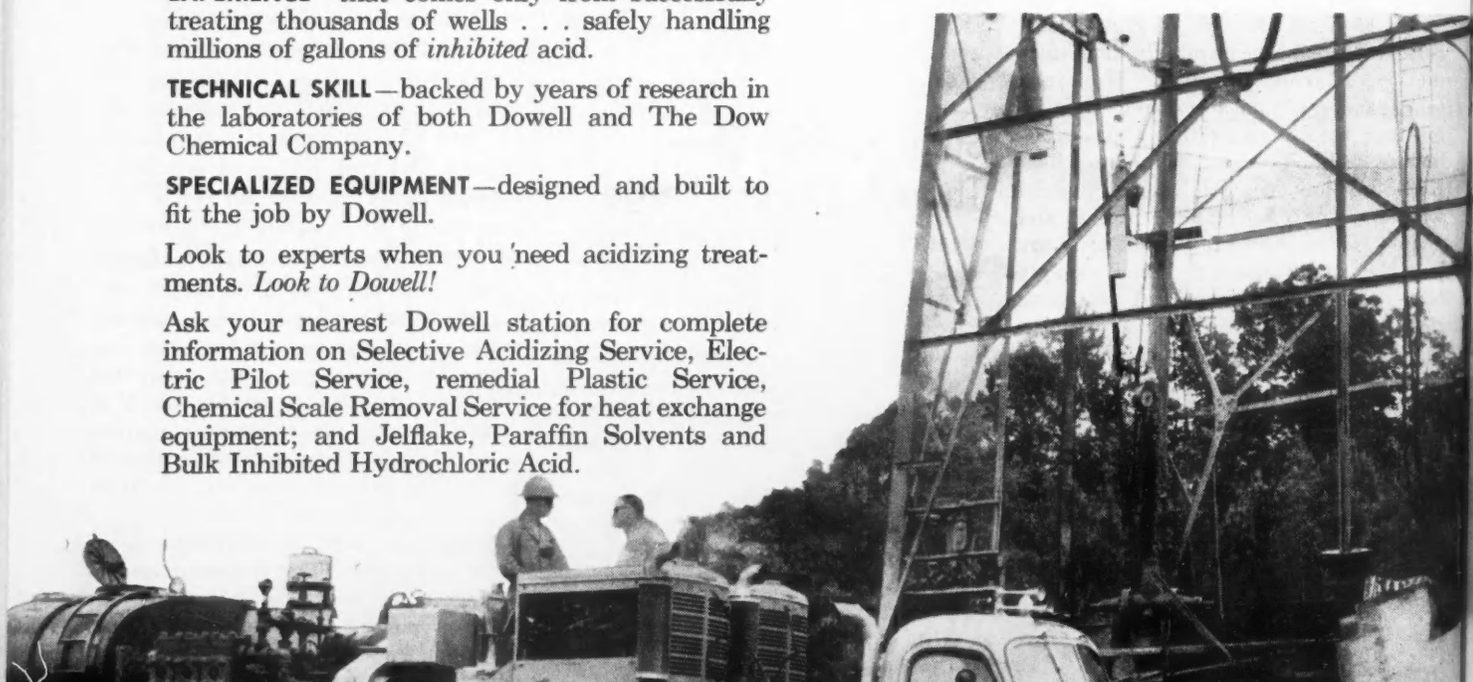
EXPERIENCE—that comes only from successfully treating thousands of wells . . . safely handling millions of gallons of *inhibited* acid.

TECHNICAL SKILL—backed by years of research in the laboratories of both Dowell and The Dow Chemical Company.

SPECIALIZED EQUIPMENT—designed and built to fit the job by Dowell.

Look to experts when you need acidizing treatments. *Look to Dowell!*

Ask your nearest Dowell station for complete information on Selective Acidizing Service, Electric Pilot Service, remedial Plastic Service, Chemical Scale Removal Service for heat exchange equipment; and Jelflake, Paraffin Solvents and Bulk Inhibited Hydrochloric Acid.



PRODUCTION INCREASED AFTER 10 YEARS!

A Permian Grayburg well completed in 1937 was squeezed with 75 sacks of cement to shut off water. Production remained at one b.o.p.d. and ½ b.w.p.d. for 10 years despite acidizing in 1940. At the suggestion of a Dowell engineer, the well was gun perforated in the open hole from 2550 to 2610 and then acidized with 2000 gallons of Dowell X. Production increased to 50 b.o.p.d.

DOWELL INCORPORATED, TULSA 3, OKLAHOMA

Subsidiary of The Dow Chemical Company

"Petroleum Promotes Progress"

Look to

DOWELL

FOR OIL INDUSTRY CHEMICAL SERVICE

A PIANO PLAYER'S SWAN SONG

WITHIN A MONTH of the time this issue of WORLD OIL reaches its readers, a U. S. national election will have come and gone. What happens in that election will do more to affect our national future than most of us can imagine.

Not even in the hey-day of the New Deal, when the ownership of property was hailed by many as a badge of shame, did public utterances by the chief executive sink to the depths of demagoguery which Harry Truman plunged them on his recent trip across the nation.

Nor was this the first time when he sought to gain a dubious advantage by attempting to stir up hatred amongst peoples.

We well remember his speech the night he accepted the nomination in Philadelphia. At the beginning of the acceptance speech he reminded us of a little ficety dog standing in front of the lion's cage, snarling and barking. Then it came to us that this man was in deadly earnest. He was in earnest in reminding certain groups that the Democratic party had bought and paid for their votes. He was in earnest in his vitriolic blasts at those who opposed his political ideas. (There may have been some doubt in the minds of many of his listeners as to just what his ideas were, since he has been consistent only in his inconsistency since he became president.)

Sitting with us and listening to the acceptance speech by Truman that night was a man who manages the West Coast affairs of a small company. As he listened he turned and said: "If that man is elected I am going to resign my job and go to Mexico and go into business with my brother. No business or any employe will be safe if Truman is re-elected—after this insight as to how he feels."

We all may be thankful that the signs all point to his exit from politics as a result of the election.

DOWN IN TEXAS an oil man who formerly headed the independent producers and royalty organization, has announced for the U. S. Senate on the Republican ticket. His announcement comes at a time when the Democratic nomination for senatorship is in such a snarl as has seldom been seen in any state. Jack Porter, the Republican candidate, has been for many years WORLD OIL'S sounding board when we have wanted to get an idea of how the independents felt on a given matter. We have found Jack a sound thinker and a scrapper. We are for him for the Senate and we hope that he walks away with the election.

BACK IN the pre-World War II days a group of American citizens, associated with individuals whose citizenship requirements had not been completed, and some men and women in the pay of a foreign government, organized the "Bund" and as a result some were prosecuted and some were deported, because their motives and actions were such as to endanger the welfare of the U. S. In our opinion they got what was coming to them.

Today it appears that if you want to get away with what the Bund wanted to get away with, you organize a political party and run for the presidency or vice-presidency, and all is well. You are given radio time and you are a liberal, even though you favor an idea which enslaves humanity in the identical manner that Fascism or Nazism did.

It is an interesting sidelight that the leaders of this new movement were high in the councils of the New Deal. One would today have been president of the U. S. had it not been for a political revolt of the people in that area which some of them contemptuously refer to as the South.

A YEAR has passed since WORLD OIL became a monthly publication. During that time a lot has happened. First even our own organization has gotten out of the habit of referring to WORLD OIL as *"The Oil Weekly"* which was the name it had had for so many years prior to the change. Next our friends and subscribers—they are one and the same to a big extent—also have come to use the new name naturally. A U. S. Court has upheld our right to the use the name and the decree made final. Circulation has continued to grow at a rapid clip. Advertising volume has fully met the anticipation we had when we planned the change to a monthly—but best of all (because one likes to have his judgment confirmed), more and more we are hearing subscribers say—"I like the monthly better than I did the weekly —congratulations on a good job."

Thanks to everybody.

THE INTERNATIONAL Petroleum Exposition directors have decided to make the Exposition at Tulsa an every-four-year affair. We think they acted wisely. The next show will be in 1952 and it ought to be even bigger than the last.

It should be bigger not only from the standpoint of extent and quality of exhibits, but it should be bigger from the standpoint of attendance. This is a subject on which a great deal of help should be given to the men directing the Exposition in Tulsa.

Ray L. Dudley

"THOSE ARE THE 5 REASONS WHY I'M FUSSY ABOUT DRILLING VERTICAL WELLS"

"Yes, I know some of the boys claim I'm *too* fussy—but they usually change their minds when they see how it pays off. First, controlled vertical drilling takes less time and uses fewer bits. Take my last well, for instance. Totco records every 50 or 100 feet told me what I was doing every foot of the way, so I was always drilling with the most efficient weight and speed. Bottomed that hole at 5400 feet in 19 days, used 21 bits, and was never 1° off. Fellow next to me took Totco readings only when he happened to think of it: he took 23 days and 29 bits to reach the same depth. And he had a crooked hole.

"Takes less power to drill a vertical well, too. Easier going in, easier coming out, and you don't wear out your drill pipe so fast, either. Another thing—drill a vertical hole, and you don't have to worry about stuck casing. You'll land the casing right where you want it, and get a better cement job, too. And if you want to hear some bad language, just ask one of the production boys about the trouble he has pumping in a crooked hole.

"But the big thing to me about controlled vertical drilling is the way it cuts down key-seating, washouts, twist-offs and the like. No rig-time lost on fishing jobs, no lost tools. No whipstocking. No backing up and re-drilling. Man, when you think it over, you can't *afford* to drill anything but a vertical well."

"That's why I drill vertical wells . . . I've neither the time nor the money to drill crooked wells!"

Based upon the actual statements of hundreds of drillers and drilling superintendents in all parts of the country and in many foreign fields.

TOTCO

TECHNICAL OIL TOOL CORP., Ltd.

1057 N. LA BREA AVENUE • LOS ANGELES, CALIFORNIA

Exclusive Distributors: California — REPUBLIC SUPPLY COMPANY OF CALIFORNIA • Domestic outside California — CONTINENTAL SUPPLY COMPANY • Canada — OIL WELL SUPPLY COMPANY • Export (except Canada) — LUCEY EXPORT CORP., New York

MONTHLY NEWS ANALYSIS

OIL SHORTAGE STILL POSSIBLE . . . STRIKE CUTS WEST COAST PRODUCTION
ADEQUATE TANKER SUPPLY EXPECTED . . . . OIL EARNINGS LESS THAN THEY SEEM
CRUDE PRICES RAISED . . . PRODUCING COST UP . . . OIL SHOW SET FOR 1952

Supply Now Exceeds Demand But Shortage Still Possible

The industry has been fairly successful in expanding oil supply to provide a margin above current high demand. But the margin still is too thin for comfort or safety. The industry hopes it can go through the coming winter without finding itself unable to meet the petroleum requirements of all consumers. But executives and economists of the industry and of government still qualify their forecasts of sufficient supply. They still warn that conservative use of oil products is incumbent upon the consumers, so that there will be less likelihood of shortages.

While increased supply has reduced the threat of shortages, the forecasters say, the possibility of serious shortages still remains, and shortages could be precipitated by one or a combination of various conditions, such as severe winter weather, serious oil industry strikes, maritime strikes, work stoppages in other industries supplying the oil industry, interruption of petroleum imports, unexpected large increases in military requirements for petroleum products, or other unforeseen circumstances.

Slenderness of the excess of supply over demand was emphasized at the middle of September when nationwide stringency of oil supply was threatened as a result of the oil industry strike on the Pacific Coast. After the strike had run without settlement for two weeks, there was danger that the region would begin drawing in supplies from the Rocky Mountain, Mid-Continent, and Gulf Coast districts, thereby creating shortages in those areas and also in the Middle West and on the East Coast, which normally depend heavily on Southwest sources. On a smaller scale, a similar effect was caused by strikes against a major company in the Middle West. After several of its refineries in Ohio had been shut down for a protracted period because of strikes, Standard Oil Company of Ohio advanced heating oil prices with the explanation that it had to do so to cover extra costs due to buying supplies from others in the open market. Besides affecting price, the strike contributed toward creating shortage.

Three Forecasts Agree Oil Needs Will Be Barely Met

Within the past month new forecasts of petroleum demand and supply have been made public by three well qualified sources: the economics advisory committee of the Interstate Oil Compact Commission, the Independent Petroleum Association of America, and the U. S. Bureau of Mines. All three forecasts offer hope that henceforth the industry will be able to provide supply equal to demand. But the forecasts also indicate only a small margin of supply above demand, which could be wiped out and replaced by shortage in event of restriction of supply by strikes or other cause or in case of unexpectedly high demand caused by increased military orders, very cold weather, or other things.

In its report, the Interstate Compact committee said that remarkable success has been realized within the past six months from the large postwar program of development and expansion, carried out by the industry in trying to meet the unprecedented demand for oil. "Although the supply situation is now easier than it has been for many months," stated the committee, "there exists such a slight margin of capacity above requirements that the industry should continue its efforts to increase supplies and consumers should strive for economy and efficient use of petroleum products."

The committee calculated that domestic demand averaging 6,400,000 barrels daily next winter can be met as follows: (1) domestic production of 5,600,000 barrels daily of crude oil and 415,000 daily of natural gas liquids; (2) net excess of imports over exports of about 200,000 barrels daily for the six months starting October 1; and (3) seasonal withdrawals from previously accumulated stocks of 180,000 barrels daily.

Demands for the coming winter are estimated by the committee to show an increase over the preceding winter of 450,000 barrels daily or 7 percent.

Following additions to storage averaging about 310,000 barrels daily in the second and third quarters, stocks have been rebuilt to adequate working levels, stated the Compact committee, and withdrawals of about 180,000 barrels daily can be made next winter while maintaining inventories that would be sufficient for normal operations. In the year ending March 31, 1949, the committee estimates that stocks of all oils will have increased by 25 million barrels or about 5 percent. If these inventory levels are realized, it said, no serious distribution difficulties in the first quarter of 1949 are anticipated. Crude oil inventories have been reduced to very low levels and requirements as estimated by the committee call for an addition to crude stocks of 10 million barrels during the next six months.

Crude production of 5,600,000 barrels daily and refinery runs of 5,700,000 daily will be required for the next seven months to meet demand, estimated the committee. Such levels of operation are only slightly above the recent monthly records and seem quite reasonable of attainment, said the committee, in view of the upward trend that has prevailed for some time. The forecast

Total Petroleum Demands
(Thousand Barrels Daily)
(Source: Interstate Oil Compact Commission Forecast.)

	*Winter 1947-1948 (Oct. 1-Mar. 31)	Winter 1948-1949 (Oct. 1-Mar. 31)	CHANGE	
			Quantity	Percent
Gasoline	2232	2412	+180	+ 8
Kerosine	403	443	+ 40*	+10*
Distillate Fuel Oils	1194	1350	+156*	+13*
Residual Fuel Oils	1563	1583	+20	+ 1
Other Products	902	955	+53	+ 6
Total Demand	6294	6743	+449	+ 7
Domestic Demand	5935	6390	+455	+ 8
Export Demand	359	353	— 6	— 2

* Winter of 1948-49 is assumed to be normal, compared with a colder winter than normal in 1947-48.

anticipates an increase in imports from 485,000 barrels daily this summer to an average of 550,000 daily next winter. Exports are assumed to average 350,000 barrels daily for the six months beginning October 1, or about the same as last winter.

Refineries face the necessity of increasing the yields of kerosine and distillate fuel oil sharply to meet demands over the next several months and of reducing yields of residual fuel oil, said the committee.

The new forecast of the Independent Petroleum Association of America checked rather closely with the Interstate Compact estimates but placed demand about 100,000 barrels a day higher and estimated required crude production at 5,700,000 barrels daily for the six months, October 1, 1948, to March 31, 1949, compared with the Compact committee's estimate of 5,600,000.

The U. S. Bureau of Mines embodied a revised forecast for the year 1948 in its monthly petroleum forecast for September, 1948.

"Increased oil supplies in 1948 should provide for a substantial increase in refined stocks and for a 7 percent increase in total demand compared with 1947," stated the Bureau of Mines, "including a decline in exports of about 14 percent and a gain of almost 9 percent in domestic demand in continental U. S. This increase in domestic demand includes estimates of a 10 percent gain in the demand for motor fuel compared with 1947, a 19 percent increase in the demand for light fuel oils, and a 14 percent increase in the demand for kerosine."

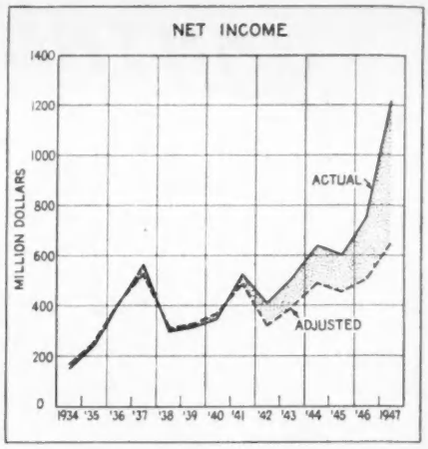
Inflated Industry Earnings Are Less Than They Seem

Real earnings of the petroleum industry, like real wages of workers, currently are less than they seem, because the dollar with which profits and wages are measured now buys much less than before the war.

This fact about oil company earnings is made clear in the recently published report, "Financial Analysis of Thirty Oil Companies for 1947," by Dr. Joseph E Pogue and Frederick G. Coqueron of Chase National Bank.

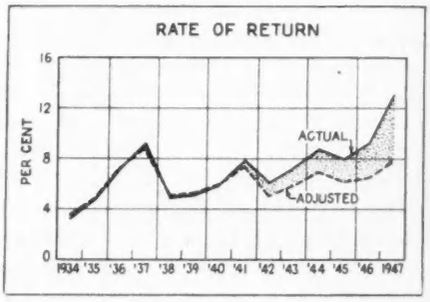
For the first time, the financial results are presented not only in "current" dollars but also in "prewar" dollars, based on 1935-1939 indices, thus measuring the effects of inflation on the industry's operations.

Reported net income of the 30 oil companies in 1947 was $1219 millions, but this total expressed in prewar dollars would be only $648 millions, a moderate profit, especially considering increased investment. Thus the reported net income for 1947 contained a component amounting to $571 millions which represented the extent that the purchasing power of the dollar has declined



since the 1935-1939 base period, the study points out. Similar adjusted comparisons are made for cash dividends, capital expenditures, return on capital, and capital charges.

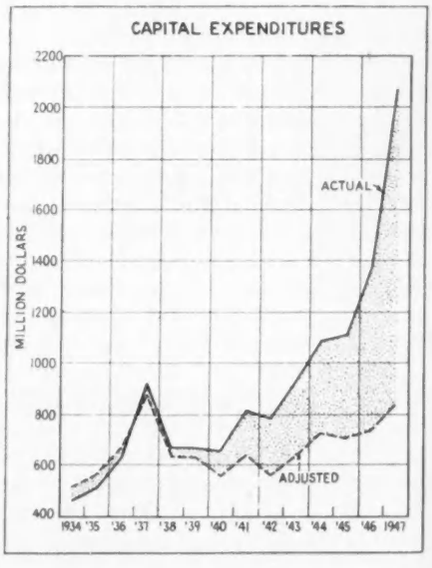
Return on borrowed and invested capital for the 30 companies in 1947 as shown in financial reports was 13.2 percent, an exceptionally high figure, but after adjustment to prewar dollars, this



return was cut to 7.7 percent, which was not much above average. Similarly adjusting results in other years to a "stable" or "prewar" dollar, the study showed that "adjusted" return on borrowed and invested capital for the same 30 companies was as high as 8.8 percent in 1937 and 7.4 percent in 1941, with the return 5.0 percent or higher every year since 1935.

Revised Forecast, 1948, United States Supply and Demand, All Oils
(From U. S. Bureau of Mines Monthly Petroleum Forecast for September, 1948.)
(Millions of Barrels.)

	First Quarter Actual	Second Quarter Actual	Third Quarter Forecast	Fourth Quarter Forecast	1948 Year Forecast	1947 Year Actual
Production	522.3	536.7	547.0	554.0	2,160.0	1,988.8
Crude	486.6	501.4	510.6	515.4	2,014.0	1,856.1
Other Oils	35.7	35.3	36.4	38.6	146.0	132.7
Imports	43.2	43.4	47.4	53.0	187.0	159.6
Crude	25.5	29.8	33.7	36.0	125.0	97.5
Refined	17.7	13.6	13.7	17.0	62.0	62.1
New Supply	565.5	580.1	594.4	607.0	2,347.0	2,148.4
Change in Stocks	−9.3	+32.4	+25.9	−12.0	+37.0	−5.0
Crude	+3.5	−2.8	−1.8	+4.1	+3.0	+0.5
Other Oils	−12.8	+35.2	+27.7	−16.1	+34.0	−5.5
Total Demand	574.8	547.7	568.5	619.0	2,310.0	2,153.4
Motor Fuel	192.6	238.1	252.3	231.0	914.0	842.4
Residual	144.1	125.1	122.8	144.0	536.0	529.1
Distillate	119.5	75.8	70.7	114.0	380.0	328.1
Kerosine	40.4	21.3	21.8	38.5	122.0	109.7
All Other	78.2	87.4	100.9	91.5	358.0	344.1
Exports	28.1	37.2	42.2	34.5	142.0	164.4
Crude	8.8	10.3	11.9	10.0	41.0	46.1
Refined	19.3	26.9	30.3	24.5	101.0	118.3
Domestic Demand	546.7	510.5	526.3	584.5	2,168.0	1,989.0
Motor Fuel	185.9	227.4	240.7	222.0	876.0	794.8
Residual	142.2	121.7	120.1	141.0	525.0	518.4
Distillate	114.5	69.2	62.3	109.0	355.0	298.2
Kerosine	39.7	20.3	20.5	37.0	117.5	102.5
All Other	64.4	71.9	82.7	75.5	294.5	275.1
Daily Average (Thousands of Barrels)						
Total Production	5,740	5,898	5,946	6,022	5,902	5,449
Imports	474	477	515	576	511	437
Change in Stocks	−103	+356	+282	−130	+101	−14
Total Demand	6,317	6,019	6,179	6,728	6,312	5,900
Exports	309	409	459	375	388	451
Domestic Demand	6,008	5,610	5,720	6,353	5,924	5,449
Runs to Stills	5,372	5,614	5,660	5,700	5,587	5,075
Demand Domestic Crude Oil	5,318	5,548	5,580	5,562	5,503	5,084



NUMBER 1 OF A SERIES PRESENTING:

Pacific's Proved Performance

in years of uninterrupted service!

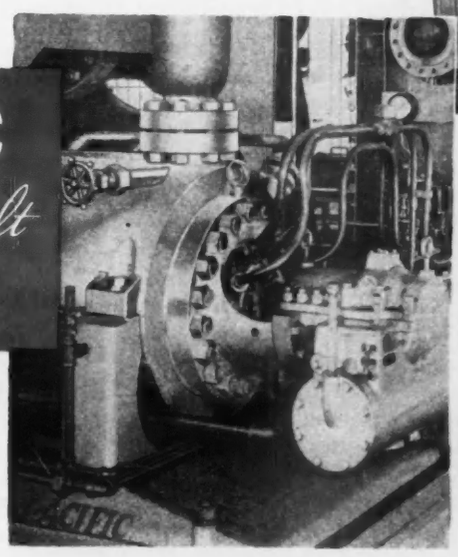
In January 1938 Wilshire Oil Company installed a 4-inch, 8-stage PACIFIC PUMP, Type ITB, Serial Number 4445. Following good practice, this pump was thoroughly inspected and checked in January 1939 and then returned to service.

Look at the Log:

From January 1939 to March 1948 this PACIFIC PUMP was on stream a total of 62,789 hours...delivered 31,000,000 bbls. of 600°F. oil against a discharge pressure of 800 p.s.i.g. THAT'S PACIFIC DEPENDABILITY!

During this same period the stuffing boxes were repacked 5 times and, in April 1946 one new shaft sleeve was installed...PACIFIC PUMP maintenance cost from January 1939 to March 1948 was only .0164¢ per 1000 lbs. of oil pumped. THAT'S PACIFIC ECONOMY!

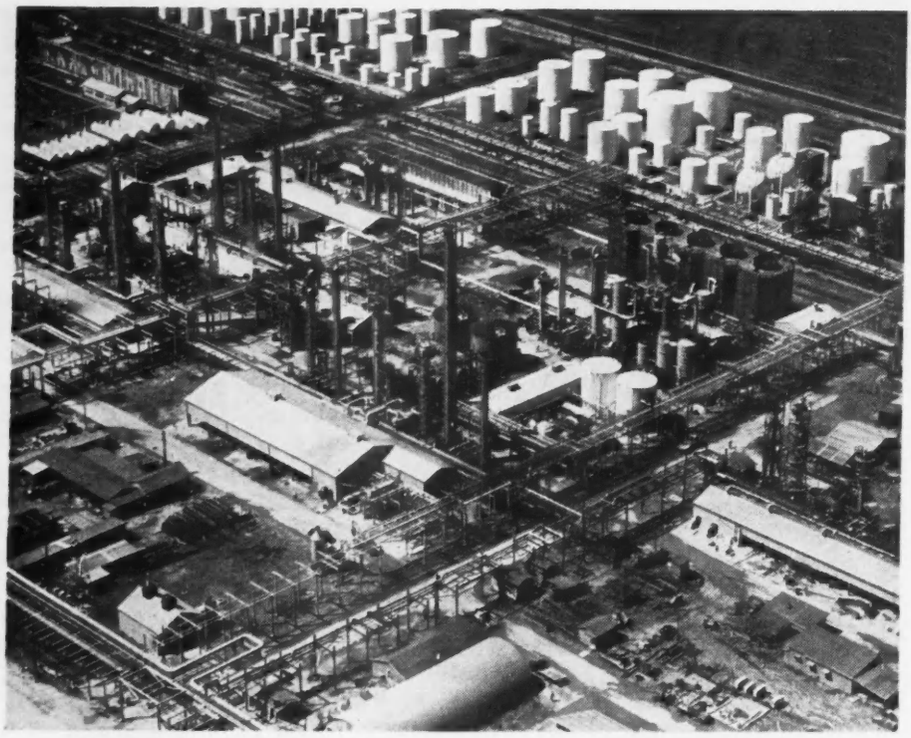
Because this PACIFIC PUMP had not been opened for inspection during its many years of continuous service, it was deemed advisable to check the interior clearances and replace parts if necessary. The check was made during the March turn-around and the pump returned to service to continue its outstanding performance record. THAT'S PACIFIC SERVICE!



PACIFIC *Precision Built* PUMPS

PACIFIC PUMPS INC.
Huntington Park, California
One of the Dresser Industries
Export Office:
Channin Building, 122 East 42nd Street, New York
Offices in All Principal Cities

PR-4



SHELL'S NEW PLANT—**In this new Shell Chemical Corporation $8 million plant near Houston, glycerin is being produced synthetically in commercial quantities for the first time in history. Basic raw material is cracked petroleum gas from an adjoining Shell refinery. Thus, glycerin becomes another of the numerous products now being made from petroleum. Glycerin is widely used in the preparation of explosives, medicines, pharmaceuticals, cosmetics, paints, enamels, lacquers, cellophane, and such every-day articles as cough drops, tooth paste, shaving cream and toilet soaps.**

Tanker Building Promises Continued Adequate Supply

Supply of tankers remains adequate, in contrast with the shortage last winter, and no further scarcity is expected at least within the next year. The present improved supply reflects return into service of tankers that have been repaired and also of ships transferred from government to private operation where more continuous usage is assured. The promise of continuing sufficient supply is based in part on the substantial tanker construction under way throughout the world and upon the steel allocation program for tankers.

A voluntary steel allocation program has been approved by U. S. Attorney General Clark under which nearly 40,000 tons of steel per month would be earmarked for construction and repair of tankers.

The allocation program is expected to step up sharply the already accelerated tanker building schedule. One out of every five ships currently being built is a tanker, and the National Petroleum Council's petroleum tanker transportation committee reports that there were approximately 280 tankers of T-2 equivalence under construction or on order as of April 1, 1948. More recent additions, the committee reports, bring the number to 299, for which "a conservative rate of delivery" is as follows: 22 in 1948, 68 in 1949, 68 in 1950, 75 in 1951, 55 in 1952, and 11 in 1953, bringing the total to 299.

NPC's committee adds: "It now appears that a total of 171 additional T-2 equivalents will be available for use by the latter part of this year as compared with the peak winter period of 1947-1948."

The committee expresses the belief that world availability of tanker tonnage should balance demand for at least the coming 12 months period.

The report shows a worldwide tanker fleet of 1264 T-2 equivalents as of April 1, 1948.

At the present time, American-flag tankers, both government-owned and private, total more than 42 per cent of the entire world's tanker tonnage. More than half of the American fleet is in service between South American and Gulf points and the Eastern Seaboard.

Oil Output Cut Sharply By Pacific Coast Strike

Tending to offset any benefits to be gained by the oil workers' union through the Pacific Coast strike will be the large loss by the union of the sympathy and good will of hundreds of thousands of motorists and other petroleum product consumers who have been inconvenienced or threatened with oil shortages.

In reflection of public opinion, some West Coast newspapers have called for outlawing of industry-wide strikes.

Demanding wage increases of 21 cents an hour as compared with oil company offers of 12½ cents, 16,000 refinery, pipe line, and production workers of Oil Workers' International Union (C.I.O.) on Pacific Coast went on strike September 3 against all major companies of the region except one, which was not affected because its contracts with O.W.I.U. will run until February.

Three weeks later negotiations had yielded no settlements. Crude production was averaging about 700,000 barrels daily, against 950,000 daily before the strike. Refinery runs, initially cut by the strike from about 880,000 barrels daily to about 250,000 a day, were brought back up to about 400,000 daily as unstruck plants boosted throughput while some struck plants were operated partially by supervisory personnel.

State and federal governments lent efforts toward ending the strike, and the public was urged to use petroleum products as sparingly as possible.

Crude Raise Explained As Needed to Assure Supply

Although the crude oil market had appeared to be growing more stable in recent months, with supply in better balance with demand, the price structure was unexpectedly shaken September 28 by the posting of an increase of 35 cents a barrel in the Mid-Continent by Phillips Petroleum Company. Whether or not the increase would be met generally by other purchasers was not clearly indicated at WORLD OIL press time.

Phillips, which purchases crude in Oklahoma, Kansas, Texas, and Arkansas, raised its prices 35 cents a barrel. Its new schedule put the top price for Oklahoma-Kansas crude (40 gravity and above) at $3 per barrel.

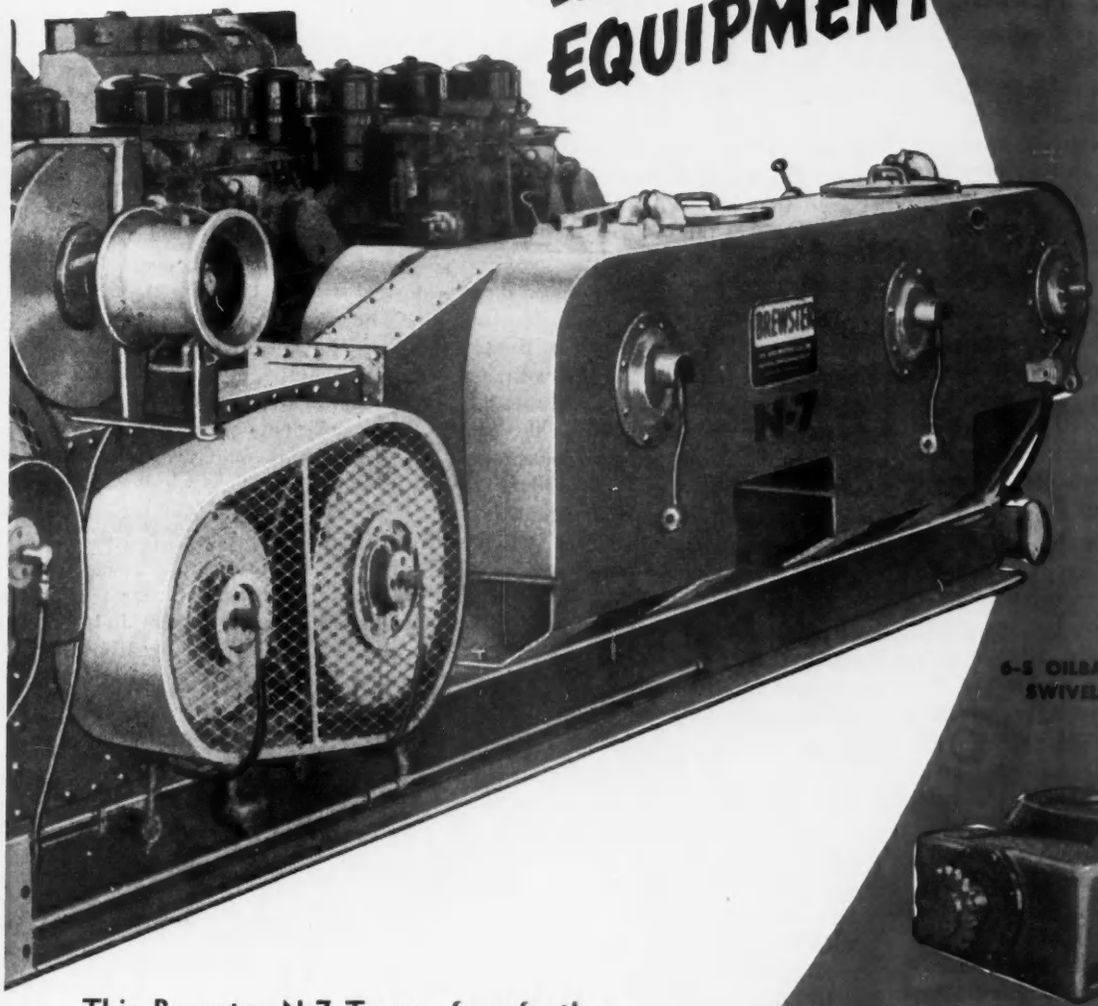
In announcing the increase, Phillips explained that crude prices must be "more nearly adequate" to cover inflated costs of finding and developing new crude reserves if unprecedented requirements for crude are to be supplied.

When Phillips raised crude prices a year ago, the lead was followed fairly shortly by other buyers of crude. However it was not so certain that this would be the case after the September 28 raise, although the history of price increases showed only one instance in recent years of where a price increase by one company was not followed by others.

The price increase was of course welcomed by most producers of crude oil, although there were some who had ex-

7500′ DRILLING

WITH MATCHED EQUIPMENT



200 TON BLOCK

6-S OILBATH SWIVEL

RS-18 OILBATH ROTARY

This Brewster N-7 Team of perfectly matched equipment delivers maximum drilling efficiency and economy. The N-7 Drawworks is conservatively rated for 7500′ drilling with 4½" pipe. Write today for N-7 Catalog WO-107.

The Brewster N-2 Team is for 2500′ drilling; ask for Catalog WO-108. The N-4 Team is for 4500′-5500′ drilling; write for Catalog WO-113.

BREWSTER
Drilling Equipment

THE BREWSTER CO., INC.
Manufacturers of Drilling Equipment Since 1910
SHREVEPORT, LOUISIANA, U.S.A.

pressed themselves to WORLD OIL during the past two months as fearing that a further price increase could do them harm in Washington.

Fred W. Shield, San Antonio, new president of Independent Petroleum Association of America, informed of the Phillips crude raise at the IPAA annual meeting, approved the increase. He said that it was "long overdue," and that it would "insure greater production of domestic oil, by making it economically-feasible to operate secondary recovery projects and by helping to finance marginal operations."

Various independent operators at the IPAA meeting declared that better crude prices would increase exploration and make more oil available.

Announcement of Phillips' price action was timed with the annual meeting of the Independent Petroleum Association of America, and a large number of Phillips men were present at the meeting. In October, 1947, Phillips announced a 20-cent per barrel increase when the Texas Mid-Continent Oil & Gas Association was holding its annual meeting.

Hines H. Baker, president of Humble Oil & Refining Company, largest Texas crude purchaser and often a leader in posting new prices, said that his company did not intend to increase its crude prices unless forced to do so by a change in competitive conditions.

Baker declared: "Humble does not consider an advance in crude oil prices required or warranted to meet demand at this time in view of the improved U. S. petroleum supply situation, a slackening in the rate of increase in demand, and the ability which the industry has demonstrated to meet current and anticipated demands.

"Domestic petroleum supply is now at record levels," he continued. "Additions to stocks of major products were at the rate of 450,000 barrels daily in July and August, and major product stocks on September 18 east of California were 38 million barrels, or 23 percent higher than a year ago. Along with this improvement in supply, there has been a slowing down in the growth of demand, as indicated by the latest report of the Bureau of Mines, which shows an increase in demand over the comparable period last year of only 3.3 percent in July as compared with 6.7 percent during the first half of this year."

"Unwise, unsound, ill timed," was the way one executive of another purchasing company in Houston termed the Phillips raise. "Supply and demand are more in balance right now than they have been in some time, and there is less reason for this price increase at this time than there would have been for several months," he added.

Executives of three other large purchasing companies, contacted by WORLD OIL, expressed similar opinion.

O. C. Schorp, president of The Carter Oil Company, declared: "At the moment we have no intention of meeting the increase. I don't consider the shortage of oil great enough to justify a price increase at this time."

M. M. Mershon, Public Service Company of Oklahoma, said: "The raise will be advantageous to us but there may be repercussions to the consumer."

T. R. Snow, vice president of Barnsdall Oil Company, commented: "I am happy to see the increase in price and I believe that on the basis of cost of production, it is justified. However, I hope the cost of products will not increase to a point detrimental to the consumer market."

An official of Deep Rock Oil Corporation who did not wish to be quoted declared that his firm was standing by but would meet the increase rather than lose pipe line connections.

Last spring and early summer there was considerable talk of a possible further increase in crude oil prices. Supply of crude was tight, and there were reports of premiums being paid in amounts as high as 35 cents a barrel. In the past three months, however, the possibility of another crude raise appeared to be diminishing, as increased domestic production and somewhat larger imports brought crude supply more nearly in balance with demand.

The prices initiated by Phillips were the highest for the crudes involved since the World War I period.

The increase September 28 by Phillips was the first crude price change since the 50-cent increase initiated December 6, 1947, by Sun Oil Company, which in turn had followed a 20-cent raise by Phillips on October 15, 1947. These increases had been preceded by advances of 25 cents March 10, 1947; 10 cents November 15, 1946; 25 cents when oil prices were decontrolled July 25, 1946; and 10 cents authorized by the OPA on April 1, 1946. During World War II Mid-Continent 40 gravity crude was frozen at $1.25 per barrel.

Phillips Petroleum Company is an integrated company with crude production and crude runs to refinery stills closely balanced, although its refining capacity has been increased substantially in 1947 and 1948 until it now exceeds company crude production. About six months ago the company's crude production was reported to be averaging about 105,000 barrels daily. At the same time it had eight refineries with reported capacity of approximately 147,500 barrels daily.

Cost of Producing Crude Up 87 Cents in 3 Years

Cost of finding, developing and producing crude petroleum was $2.86 a barrel in 1947, an increase of 87 cents per barrel over 1944, according to a report submitted by the Economics and Cost Study Committee at the IPAA meeting in San Antonio September 27-28.

The committee found that "based on the indicated price necessary in 1944 of $1.99 per barrel, this increase in replacement cost of 87 cents would indicate that the price necessary in 1947 would have been $2.86 per barrel or 94 cents above the actual average price in 1947 of $1.92 per barrel. The present price averages $2.59 per barrel."

The committee further reported that "the increased cost of labor in 1948 over 1947 averages approximately 10 percent, according to official government figures. Government figures also indicate a 10 percent increase in material costs, but these figures do not reflect the large volume of materials being sold outside normal trade channels at high prices.

"The present price of crude petroleum in the U. S. is not enough to provide the producing companies with the necessary capital required to discover and develop sufficient additional reserves to keep pace with today's rising oil consumption.

"Of the amount paid by consumers for petroleum products in the U. S., only a little more than 6 cents per gallon on the average is returned to the production branch of the industry for application against the greatly increased cost of finding new oil reserves, developing these reserves, and producing liquid petroleum from these reserves."

Oil Show Scheduled in 1952 As Desired by Exhibitors

In deciding that the next oil show would be held at Tulsa in 1952, the executive committee of the International Petroleum Exposition complied with wishes of a large majority of exhibitors. A survey made by the Petroleum Equipment Suppliers Association of all of the 602 exhibitors at the 1948 exposition showed a 78 percent preference for a four-year interval.

With the year of the next show now determined and exact dates soon to be decided, exhibitors at former shows soon will be contacted by the International Petroleum Exposition regarding reservation of space for the 1952 show.

To collect some funds for maintenance of grounds and buildings during the four years until the next show, exhibitors making reservations of space will be billed in advance for possibly 25 to 30 percent of the old space rate.

NOW 3 FINE Jimmie Gray COMPOUNDS

Jimmie Gray
EXCLUSIVE 500 TON SPECIAL

Jimmie Gray
KANT-GALL TOOL JOINT COMPOUND

Jimmie Gray
LONG-LIFE DRILL COLLAR COMPOUND

Now—you have three choices in Jimmie Gray Compounds . . . each compound engineered to do certain jobs best! And both new compounds have the same dependable quality . . . the same famous money-back guarantee as the widely used Jimmie Gray 500 TON Special!

1.—EXCLUSIVE 500 TON SPECIAL—Today's most widely used tool joint compound, for proper lubrication and protection of tool joint threads. Prevents washouts and galling. Makes breaking out easier; withstands highest pressures; and is unaffected by heat and moisture.

2.—KANT-GALL TOOL JOINT COMPOUND—60% fine mesh metallic zinc and base stocks of the finest quality lubricants. Contains no filler! Especially recommended for getting the maximum efficiency and long-life from NEW tool joints.

3.—LONG-LIFE DRILL COLLAR COMPOUND—Prepared especially for use on drill collars, this compound contains a very high percentage of finely divided metallic lead. Contains no filler! Will not gall or seize; is not affected by contraction, expansion, vibrations or temperature changes.

Write us for further details.

STANDARD OIL SALES CO.

BOX 203 HOUSTON, TEXAS CHARTER 4-5648

SOLD BY SUPPLY STORES EVERYWHERE!

Looking Ahead

● BRADFORD FIELD, Pennsylvania-New York, should produce about 194 million barrels additional crude oil in the next 30 years, with benefit of secondary recovery. By end of 1977 the field's output will be down to 10,000 barrels daily from present rate of 35,000. To recover the 194 million barrels, operators will have to drill 2000 new wells annually for next ten years and at least 1000 wells annually in the following 20 years, developing 20,000 acres not yet water-flooded and redeveloping 25,000 acres previously water-flooded. These are estimates of John F. Buckwalter of Ryder-Scott Company, petroleum engineers, Bradford.

● INABILITY to meet all demand for natural gas in the Midwest and East next winter is virtually certain. A group of Midwestern utility companies already have been directed by FPC to accept cuts up to 50 percent in gas deliveries from trunk lines supplying them. Curtailment applies to interruptible sales made to companies on basis of supplying them with gas when it is available, and may amount to 50 percent of "normal requirements."

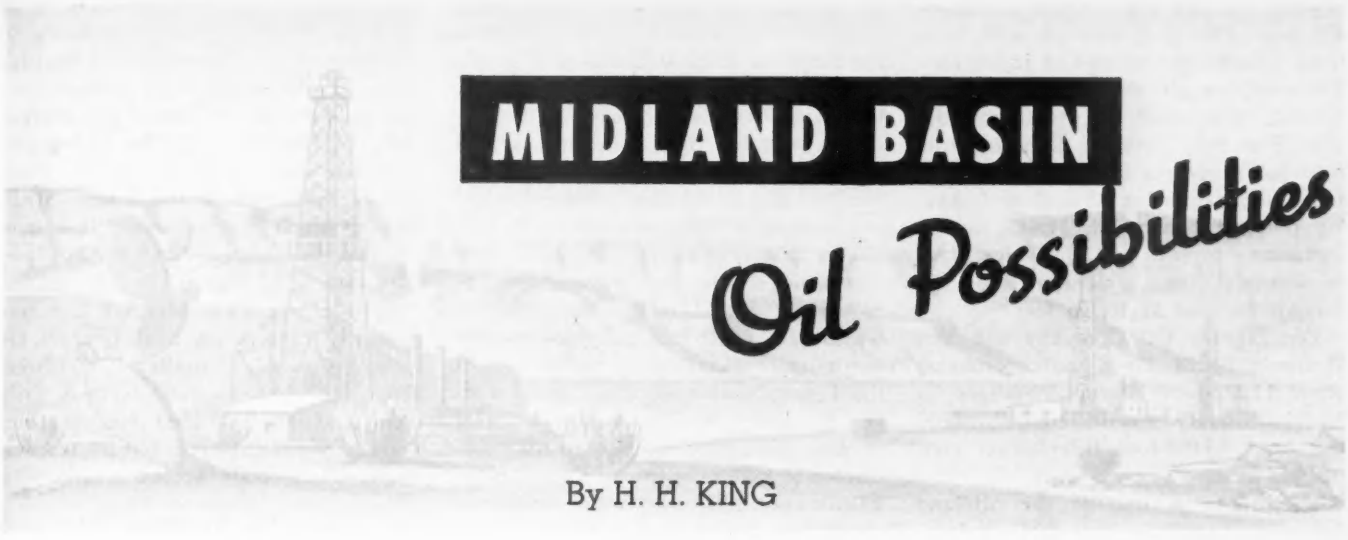
● CONTINUANCE of high prices of oils would encourage already increasing re-use of lubricating oils through re-refining of used lube. Filtering and distillation clean out dirt, water, wax, and other foreign particles. Quality of the reclaimed oil is debated. Critics say the product is not safe to use, but some chemists call it good as new, and some bus, trucking, taxi, and railroad companies as well as motorists are using it. Cost is materially less than that of new oil, and sales have increased sharply in past two years of advancing oil prices.

● AFFIRMATION of states' rights to tidelands and submerged lands in next session of Congress is hoped for by those who expect election of Republican ticket. Governors Dewey and Warren voted for Tidelands Resolution unanimously passed by Governors' Conference in July, 1947, and the Republican party has a tidelands plank in its 1948 platform.

● THE EAST TEXAS FIELD ultimately will produce a cumulative total of 5½ billion barrels of oil, it is estimated, with over 2.6 billion already recovered. This high recovery now expected, through benefit of scientifically regulated producing rates, contrasts with original expectations of only 1 billion barrels under unrestricted production methods then employed.

● U. S. HIGHWAY construction is estimated at $1¾ billion for 1948, a new all-time record, compared with $1½ billion in 1947. But still-higher annual construction rate is needed to repair, improve, and extend the highway system satisfactorily, because of wartime postponement of work and increased numbers of trucks, buses, and automobiles.

● TREND OF past quarter-century from coal toward oil and gas cannot continue indefinitely, as ultimate reserves of coal are very much greater than those of oil and gas. If demand for oil puts too much strain on available supply, price of oil will get high in relation to coal price and force use of coal where possible instead of oil. Rising oil prices already have slowed trend from coal to oil, discouraging oil-burning under boilers and in furnaces and assuring more oil for transportation and other uses where coal or other substitute fuels cannot be used satisfactorily.



MIDLAND BASIN Oil Possibilities

By H. H. KING

DEVELOPMENT of Pennsylvanian production that was temporarily passed up in the Benedum field, deepest producing area in West Texas, emphasizes the production possibilities of the Midland Basin. The field's discovery was the first in the Ellenburger for the basin, which lies immediately east of the double row of producing counties that comprise the Central Basin Platform. This platform region has contributed the most fields and a substantial portion of the crude reserves recorded by the expansive Permian Basin.

Exploration of the Midland Basin for so-called regular Permian production has been disappointing, except for the Mabee field, centering upon the Andrews-Martin County line, and a cluster of fields near the intersection of Gaines, Dawson, and Terry counties. Pre-Permian prospecting has been nominal due to the depth involved in drilling to the Ellenburger, the prime objective of all deep tests.

Discovery of the Benedum field last December from Ellenburger below the 11,000-foot level brought about a change of attitude among prospectors toward the Midland Basin. This strike and wildcats that have temporarily passed up promising production in the Basal Permian and Pennsylvanian in order to explore the Ellenburger offer convincing proof that the Midland Basin's deep structures will produce. Participating companies are speculating as to whether the average production yield per acre at such depths will be commensurate to the abnormally high development costs.

The name basin is appropriately applied to the region of deep-seated formations that centers upon Midland County, with a general north-south trend. Decisive tests of the Ellenburger will necessitate the drilling of 11,000 to 14,000-foot tests. Wildcat failures at comparable depths are becoming commonplace in West Texas now that heavy-duty rotaries are available. The average company was not interested in drilling these $300,000 wildcats in the Midland Basin until the postwar demand raised production allowables and crude prices. The need for additional crude reserves has lifted the ban on expensive wildcatting, and an aggressive period of exploration is shaping up.

Prospective Strikes

Upton County sector of the basin has three prospective deep strikes that were started after the proving of the Benedum structure. Richardson & Bass, Inc's Neal-Turner 1, 4½ miles west by north of Pennsylvanian production in the Benedum field, passed up a promising showing of 42-gravity oil, with good flow of gas, recorded by drill-stem test at 9871-10,096 feet. The most effective pay in this zone prevailed below 10,032 feet. The section tested embraces the Permian-Pennsylvanian contact, and is structurally flat with the Pennsylvanian discovery. However, Neal-Turner 1 encountered the Devonian at 11,351 feet, or 645 feet lower structurally than the Pennsylvanian producer, and was drilling below 11,700 feet to explore the Ellenburger.

FAILURE OF THE Benedum field to fulfill its rating as one of the nation's major crude reserves, as the discovery was classified by misinformed press and radio commentators, has been cushioned somewhat by the tardy appearance of prolific gas-condensate flow from the Pennsylvanian. This upper-pay zone will embrace more productive acreage than the Ellenburger pay, which is tentatively placed at 6000 to 8000 acres. Eight tests drilled to the Ellenburger, with one to granite, prove conclusively that this zone, as now explored, is void of oil accumulation, and its production is gas and condensate.

Magnolia Petroleum Company's TXL 1-A, wildcat near the Midland County line, developed a favorable showing of 40-41-gravity oil from the 9300-foot Permian in making two drill-stem tests. Two tests of the Pennsylvanian between 10,095 feet and 10,135 feet yielded a maximum flow of 11½ barrels of 46-gravity oil hourly, while the gas volume gauged a maximum rate of 1,783,000 cubic feet daily. It is contracted to explore the Ellenburger. Wilshire Oil Company's McElroy-Standard 1, western Upton County wildcat, currently occupies the lowest structural position in the Basin on the Ellenburger, which was entered at 13,860 feet and proved dry in drilling to 13,977 feet. Pipe was set at 10,810 feet to plug back and test the Strawn (Pennsylvanian), entered at 10,620 feet, and favorable oil and gas showings in the Lower Permian series.

Gulf Oil Corporation's Bryant 1-E, Midland County Ellenburger prospect, was drilling sand at 13,042 feet. The Devonian, topped at 12,025 feet, yielded nominal gas shows on drill-stem tests, and the Silurian at 12,645-762 feet returned 2250 feet of 48-gravity oil and 210 feet of salt water. This is the first definite showing developed from the Silurian in the Midland Basin.

Humble Oil & Refining Company pioneered deep exploration in Midland County in opening the Midland field through the completion of Buchanan 1 in 1945 flowing 270 barrels of 45.7-gravity oil, with gas-oil ratio 4350/1, on official gauge through 11/32-inch choke. This production was from Strawn

(Pennsylvanian) perforations at 10,370-390 feet. The well was plugged back from Ellenburger, topped at 12,170 feet. The company plugged this discovery in August, 1947, due to production decline. Humble's Turner 1, 2 miles south, recorded a pumper in 1947 from Wolfcamp perforations at 8500-60 feet, having plugged back from 11,445 feet in Devonian, topped at 11,358 feet. An unsuccessful test was made of the Strawn, entered at 10,306 feet.

Tex Harvey Oil Company and Ted Weiner's Floyd 1, ¾ mile southeast of a 11,322-foot Devonian failure in Midland County, was drilling below 9000 feet on a 13,000-foot Ellenburger contract.

The upper portion of the Midland Basin is sharing in the deep exploration. Magnolia Petroleum Company's Hicks 1, near east edge of Gaines County, was drilling below 7000 feet on a 12,500-foot Ellenburger objective. Stanolind Oil & Gas Company's American Warehouse 15, Cedar Lake field, is being deepened to 12,600 feet, or Ellenburger, after suspending operations in 1943 while in Pennsylvanian lime at 11,954 feet. No shows were recorded below the San Andres.

The upper region of the basin attracted attention when Seaboard Oil Company, Continental Oil Company and Rowan Drilling Company's Hinson 1, eastern Terry County wildcat, swabbed and flowed a small volume of oil from open hole at 9400-55 feet. This production was from the Pennsylvanian, topped at 9405 feet.

The Pennsylvanian beds were not generally considered an important source of production in the Benedum area until eight tests had drilled through the formation to the Ellenburger. The field's discovery logged gas in the Pennsylvanian that was partially confirmed by production tests made prior to deepening from its original abandoned depth.

Plymouth Oil Company's Wallace 1, three-eighths mile northeast of the discovery and the third Ellenburger producer, logged favorable showings at 9582-623 feet in the Pennsylvanian without making a drill-stem test.

The abandonment of Humble's Barnett 1, three miles northwest of the discovery, at 12,367 feet in Ellenburger, topped at 11,650 feet, provided an opportunity to ascertain the significance of the Pennsylvanian showings. Fred Turner, Jr., and J. M. Hewgley, who shared in the drilling of the discovery, contracted to take over the structurally-low Ellenburger failure to make additional production tests upon the payment of 2,300 for the surface connections and 1/16 over-riding royalty on the assigned 160-acre tract. The partnership drilled out cement in open hole below the 7⅝-inch casing seat at 8279 feet and landed 4½-inch liner at 8066-12,367 feet.

Preliminary production test from perforations opposite Ellenburger at 12,200-25 feet yielded negative results, and were squeezed to explore the Pennsylvanian through shot holes at 9982-85, 9997-10,000, 10,062-65, 10,137-40 feet and 10,177-80 feet. These five 3-foot zones of perforations responded to treatment with 2000 gallons of acid solution. The well flowed an average of 22 barrels of 55-gravity oil or condensate per hour, with ratio of 2500 feet of gas per barrel, on four-hour gauge through one-eighth inch choke. The gas ratio and gravity increased on later tests. A late gauge recorded a flow of 179 barrels of 58.7-gravity oil or condensate, with ratio of 4840/1, on six-hour test through one-half-inch tubing choke.

This new-pay discovery is credited with entering the Pennsylvanian series near the 9910-foot level, correlating 93 feet high to the Upland Pool's depleted Lower Permian discovery pumper one-half mile north. The latter was plugged back in 1945 from 10,744 feet in the Devonian due to loss of returns. These nearby tests scored the lowest structural position among those that have reached the Pennsylvanian in the Benedum area.

Apex of the Pennsylvanian structure presently centers on Slick-Urschel Oil Company et al's Standifer 1, which entered the zone at 9560 feet. A drill-stem test at 9400-580 feet returned nominally gas-cut mud, but no test was made of the main section of porosity

Big Territory

Production from the Pennsylvanian will embrace more territory than the Ellenburger pay, according to the subsurface picture as now outlined. A positive call has not been made as to whether the production is from Canyon or Strawn, although the latter is termed the most probable. Some doubt prevails as to whether Pennsylvanian production will blanket the structure in the event a lenticular condition occurs in the zones of effective pay.

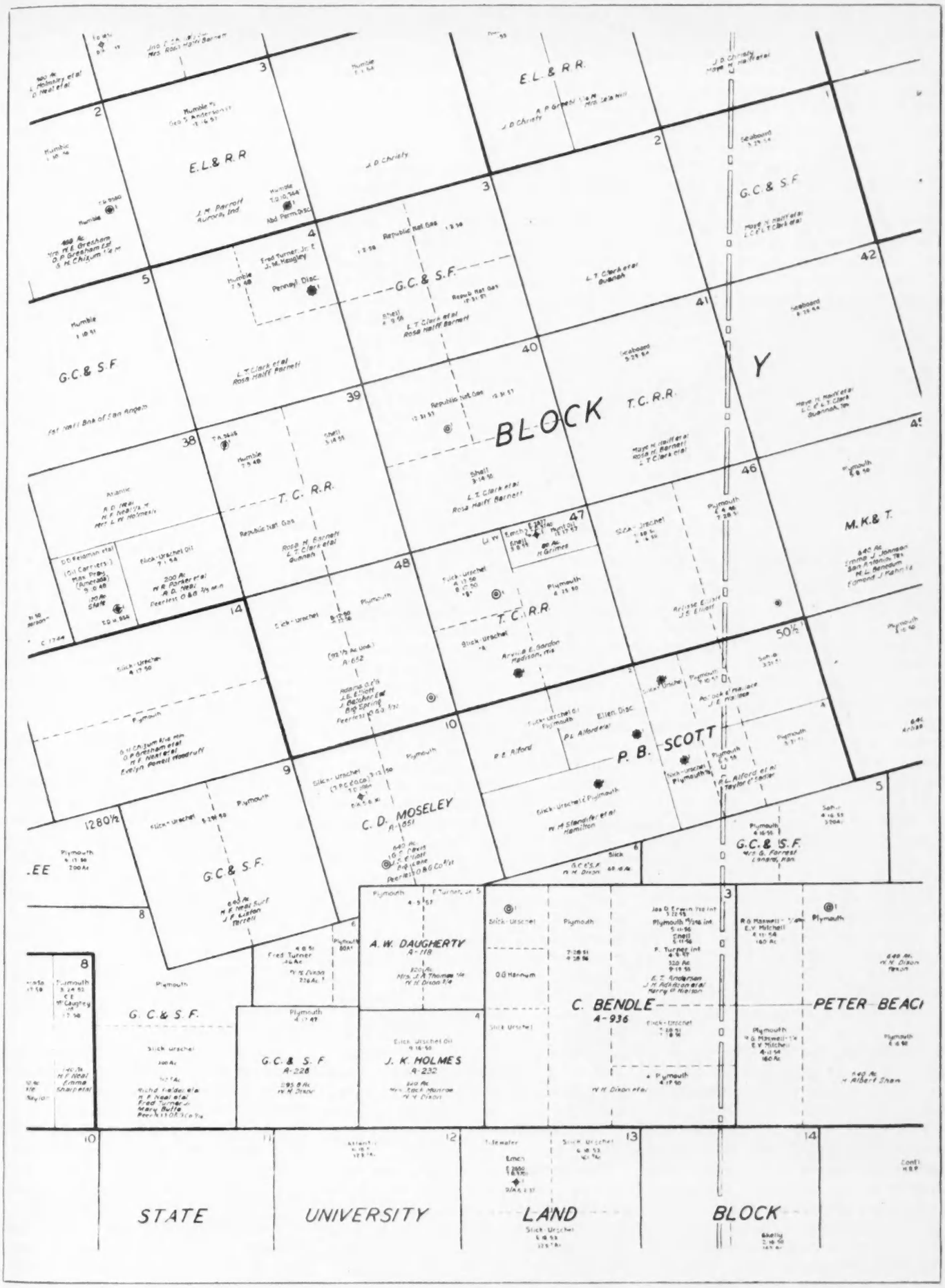
The producing contour established by the upper-pay discovery restores the west portion of the structure to prospective Pennsylvanian production after being temporarily written off by an outpost Ellenburger failure and a nearby 9545-foot Basal Permian test plugged because of its low structural position for Ellenburger pay.

D. D. Feldman-Oil Carriers, Inc's State-Amerada 1, three miles west by north of the field's discovery and two miles southwest of the Pennsylvanian producer, entered the Ellenburger at

Comparative Geological Column of Benedum Field Wells

	Slick-Urschel et al's			Turner & Hewgley's	Humble Oil & R. Co's.		Plymouth Oil Co.'s			Republic Natural Gas Co.'s	D. D. Feldman et al's
	Alford No. 1	Gordon No. 1	Standifer No. 1	Barnett No. 1	Barnett 1-B	Parrott No. 1	Elliott No. 1	Taylor-Sadler No. 1	Wallace No. 1	Barnett No. 1	State-Amerada No. 1
Elevation	2669	2689	2681	2692	2697	2699	2663	2669	2672	2693	2703
Anhydrite	....	....	....	1300	....	1300	....	....	1230	1280	1270
Yates	2110	2120	....	2195	....	2220	2230	....	....	2140	....
Grayburg	3590	....	3595	3720	3690	3765	3700	3590	3590	3660	3750
San Andres	....	3720	3720	....	3770	3810	....	3670	3680	3775	3890
Pennsylvanian	9590	9630	9560	9910	....	10010	....	9550	9570	9840	9840
Devonian	10014	10258	10142	10636	....	10737	10512	10100	10063	11546	10552
Silurian	10590	....	10702	11150	....	....	....	10710	....	11125	11098
Fusselman	10640	10845	10805	11310	....	....	....	....	....	11244	11148
Simpson	....	11020	10884	11405	....	....	....	11020	10880	11320	11205
Joins	10890	....	....	....	....	....	....	....	....	....	11517
Ellenburger	11020	11170	11064	11650	....	....	....	11281	11125	11580	11534
First Water	11587-684	....	11561-676	11851-898	....	....	....	....	....	11658-725	11600-714
Granite	....	....	12492	....	....	....	....	....	....	....	....
Total Depth	12022	11465	12505	12367	9545	10744	10550 (Drilling)	11502	11500	12036 (Will PB)	11954
Producing Zone	11885-985	11400-465	11280-490	9982-10180	....	9100-9883	....	11475-502	11480-500	....	....
Initial Production	833	882	1205*	716*	D. & A.	P. 5	....	*	520	....	D. & A
Gas-Oil Ratio	4400/1	3960/1	4180/1	4840/1	....	None	....	....	3930/1	....	....
Gravity	56.0	60.3	....	58.7	....	42.3	....	....	59.2	....	....
Choke	¾"	½"	⅜"	½"	....	....	....	....	⅝"	....	....
Date Completed	12-18-47	8-17-48	9- -48	9- -48	8-23-48	7- 7-45	....	9- -48	8-31-48	....	8- 4-48

* Official potential pending



—Map Courtesy of Southwest Mapping Company, Fort Worth.

The Benedum field's Ellenburger gas-condensate producing area is shown on the above map, with a gas-condensate producer from the Pennsylvanian on the northwest edge of the structure.

11,534 feet. This marker correlates 480 feet low to the Ellenburger strike and 81 feet high to the plugged-back Pennsylvanian well. Using a tentative Pennsylvanian top of 9840 feet, State-Amerada 1 correlates 216 feet low and 81 feet high, respectively. It was drilled on a 120-acre lease requiring production by September 10, 1948, and was abandoned August 4 after unsuccessfully testing the Ellenburger and also the 7500-foot Permian through perforations. The Pennsylvanian was passed up without a drill-stem test, and also omitted in making production tests through perforations. The hole may be re-worked for possible Pennsylvanian production when the state sells a new lease on the tract.

Humble's Barnett 1-B, midway between State-Amerada 1 and the Pennsylvanian strike, was abandoned in Permian at 9545 feet on August 23 when neighboring tests failed in the Ellenburger. Barnett 1-B is scheduled to be deepened 500 feet to try for production in the Pennsylvanian.

Geologists are reluctant to make a preliminary appraisal of the Benedum field's Pennsylvanian pay zone. Comparatively little laboratory work has been completed on the section, which consists of broken sand, shale and lime. The outlying, or structurally low tests, to the north and west of the Ellenburger producing area, are reported to register considerable more lime in the Pennsylvanian. The single producer presents a complex situation in that its output could be interpreted as establishing the presence of a gas-cap.

The field's Ellenburger zone scored an exception for the Permian Basin in failing to yield oil below the gas-cap, or gas-condensate section. The Ellenburger in the Keystone, Embar, Big Lake and others have gas-condensate production that overlies the oil column. A second exception occurred shortly after confirmation of the Benedum area for production. The Santa Rosa one-well Ellenburger field, discovered by Chancellor and Slick Oil Company, penetrated the Ellenburger 1010 feet in establishing the water table, and is awaiting official gauge as a gas-condensate producer. No oil was encountered below the gas-condensate zones.

Fast drilling time and use of water-loaded rotary mud were contributing factors that caused Pennsylvanian production to be overlooked during the early stages of development of the Benedem field. Drilling contractors are paid $10 per foot in making hole to the Pennsylvanian-Devonian contact, then proceed on day-work basis. Contractors rely upon making fast progress while on footage basis to attain an adequate profit.

Experience gained through the unexpected development of production from the Pennsylvanian in the Benedum area will result in more emphasis being placed on a decisive production test of the zone when showings occur in future prospects.

Production from the Pennsylvanian series in the Permian Basin can be termed incidental due to the fact that the Ellenburger was the prime objective. More than a score of oil and gas areas now produce from the Pennsylvanian in the district. The majority have not been profitable. However, the Todd-Crinoidal, Jameson-Crinoidal and the Page-Strawn fields have attained importance in area and daily production. While the Benedum area gives promise of becoming one of the largest, the outlook is favorable for continued expansion of the Schattel, Vealmoor, Addis, Arick and the Landon-Strawn fields. These are in the preliminary stage of development. The Barnhart field, largest Ellenburger producing area in the Permian Basin, has confirmed Pennsylvanian oil production, but it appears to be restricted to local areas.

Exploration of the Ellenburger pay in the Benedum field has progressed sufficiently to indicate from 6000 to 8000 productive acres. Failures to the northwest and west partially establish the perimeter of production for this zone. A drilling test a mile northeast of a producer correlates low on pre-Permian beds, making it doubtful for major extensions in this direction. Substantial enlargement of the Ellenburger pay is forecast for acreage situated south of the discovery. This development confirms the geopyhsical outline of the structure.

The Ellenburger strike is near the east line of Upton County, and nine miles northwest of deep production in the Big Lake field, which was the first to produce Ordovician oil in the Permian Basin. Slick-Urschel Oil Company, Fred Turner, Jr., and J. M. Hewgley completed the Benedum discovery December 18, 1947, on the Alford 320-acre tract, P. B. Scott Survey, on a farmout from the Plymout Oil Company. The group re-entered Plymouth's abandoned 10,384-foot prospect, which had tested a small volume of gas in the Devonian from open hole and some gas from Pennsylvanian perforations at 9660-95 feet.

Having failed to remove junk from the hole, the new owners drilled out through 6½-inch pipe cemented at 9750 feet, and started sidetracked hole in the 8700-foot Permian. The Ellenburger was encountered at 11,020 feet. Initial drill-stem test of the section to 11,095 feet yielded a small volume of gas. An increase in gas and first flow of condensate was recorded by test at 11,166 feet. The output of gas and condensate showed progressive gains in tests at 11,206 and 11,256 feet, while a maximum 18-million cubic feet daily rate, with condensate spray, appeared at 11,276-312 feet. Test at 12,356-412 feet yielded 1350 feet of condensate and gas. The volume of gas was rated at 100,000 cubic feet daily at 11,415-96 feet, and increased to 200,000 feet daily, with spray of condensate at 11,505-88 feet.

First Water

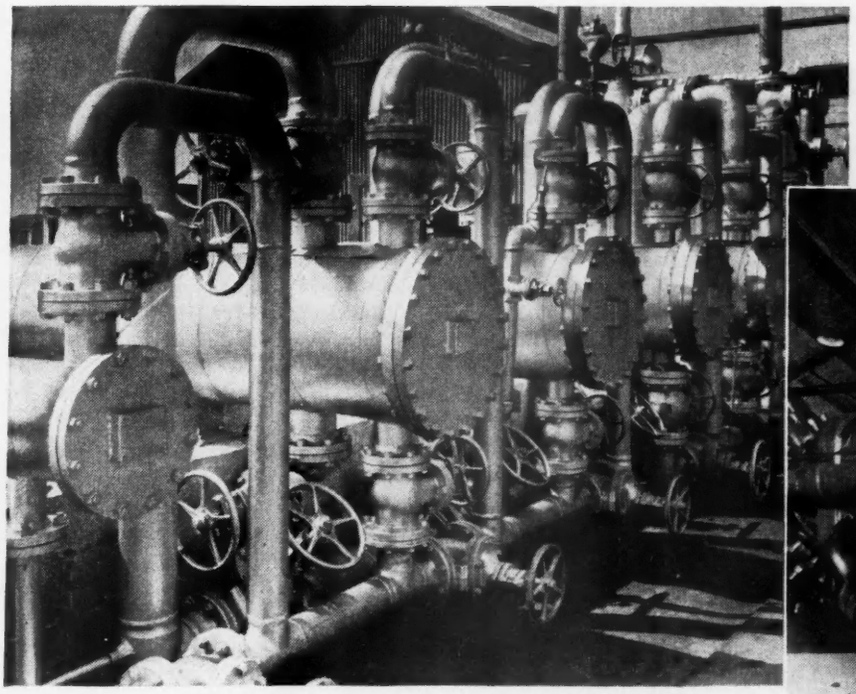
First brackish water was noted in test at the 11,587-684-foot level, which has since been confirmed as the approximate water table by three outposts and a southwest offset to the discovery. This drill-stem test resulted in a nominal flow of gas and condensate, with the drill pipe yielding 2900 feet of 52-gravity oil or condensate; 180 feet of brackish water, and 30 feet of rotary mud. The water was generally classified as contaminated drilling fluid, and dismissed as such when drill-stem tests below failed to register the presence of formation water. Three drill-stem tests between 11,722-829 feet failed, while a test at 11,831-70 feet recovered 300 feet of mud. The final run of the testing tool was made at 11,908-72 feet, accounting for 280 feet of slightly gas-cut rotary mud. The hole was deepened to 12,022 feet, or 1002 feet in the Ellenburger, for completion through five-inch liner cemented at 12,018 feet with only 80 sacks of cement.

Three zones of perforations at 11,885-985 feet, aggregating 50 feet, responded promptly to treatment with 1500 gallons of acid solution under 4500 pounds pressure for eight hours, then broke down to 800 pounds. The well recorded a potential of 833 barrels of 56-gravity condensate, with ratio of 4400 feet of gas per barrel of fluid, via ¾-inch tubing choke. Water soon made its appearance in amounts up to 7 percent of the total fluid while producing the assigned temporary allowable of 500 barrels daily. The percentage of water is erratic, as it comes in "slugs" then disappears for three or four days.

Evidence presented by the discovery group at the Texas Railroad Commission's field hearing in March revealed that the shutin bottom-hole pressure at the 12,000-foot level was calculated at 5225 pounds per square inch upon completion. A survey February 1 registered 5227 pounds. The temperature at this level was reported to be 200° F.

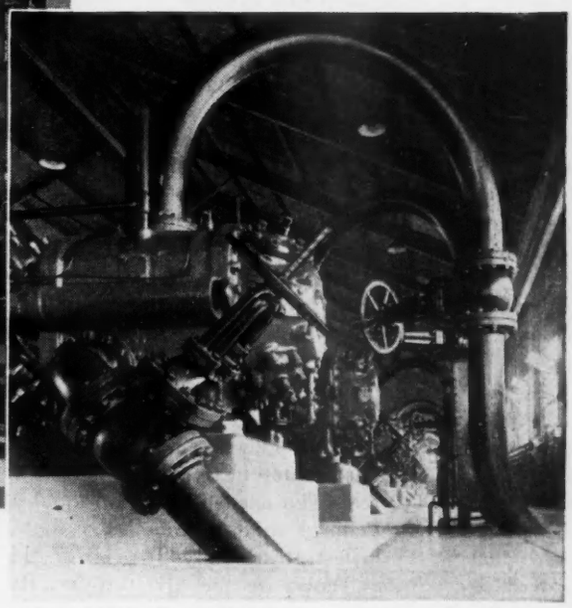
A laboratory technician testified that he could not definitely prove the presence of liquid in the reservoir as samples of the production were not available at the bottom of the hole. He stated that an analysis of the gas and fluid taken from separators indicated that the liquid

For better piping every time
get everything from CRANE



HEAT EXCHANGER BANK *in recycling plant with flanged, screwed, and welding piping materials from the complete Crane line. Standard 125 and 250-pound iron body wedge gates are used.*

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



GAS BOOSTER STATION *showing 500-pound double disc gate valves, flanged fittings, and pipe bends from Crane.*

Get everything from Crane . . . valves, fittings, pipe, accessories, shop-fabricated units. That's the easy way to help yourself to better piping performance. And to speed up and simplify every new or replacement installation for oil or gas production.

By standardizing on Crane for everything in piping, you get this 3-way advantage:

ONE SOURCE OF SUPPLY offering the world's largest selection of steel, iron, brass, and alloy piping materials for all power, process, and general service applications.

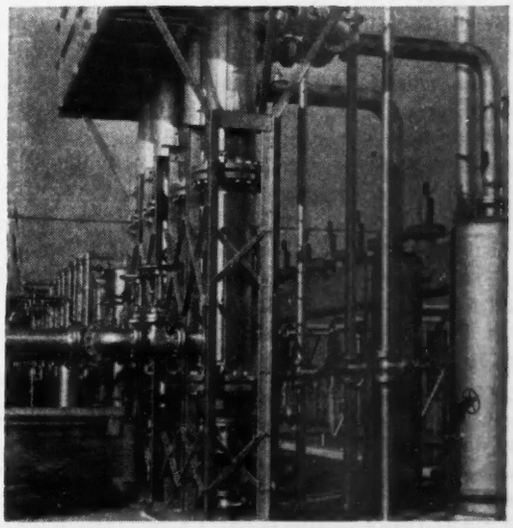
ONE RESPONSIBILITY for piping materials—helping you to get the best installation, and to avoid needless delays on the job.

OUTSTANDING QUALITY in every item—assuring uniform dependability and durability throughout piping systems.

Nearby, there's a Crane Branch or Wholesaler to give you quick, modern service . . . on everything for better piping . . . and all on one order.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Oil Country Areas

ONE ORDER TO CRANE *covers all piping equipment . . . brass, iron, and steel . . . for this large natural gas operation.*



EVERYTHING FROM . . .

VALVES
FITTINGS
PIPE

CRANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM

hydrocarbons exist in a gaseous phase in the reservoir.

The discovery's excess gas yield has been utilized for supplying fuel for drilling rigs. Later Ellenburger completions registered proportionate high gas-condensate ratios and are penalized in output to about 254 barrels daily.

Opinion prevails among geologists and engineers that the discovery is producing its gas and condensate by channelling from above the water level recorded by a drill-stem test at 11,587-684 feet due to ineffective cement job. This theory is supported by the absence of commercial production appearing in drill-stem tests made by the discovery at lower levels. It is significant that the other four tests, including the discovery's southwest offset, recorded only nominal gas showings below their respective water tables. However, geologists have not dismissed the possibility of commercial production being found below the first water table in the Ellenburger, although this would be unorthodox for Permian Basin Ordovician areas.

The water table in the Ellenburger is at a fairly uniform depth in four of the tests drilled to the zone. These established the presence of water near subsea depth of 9000 feet. The exception is the plugged-back Pennsylvanian discovery, which is the lowest structurally. It proved dry without shows on the first four drill-stem tests of the Ellenburger, then recovered 180 feet of gas-cut mud at 11,780-851 feet. High chlorine content water was recorded by a test at 11,851-98 feet.

Slick-Urschel Oil Company et al's Standifer 1, ⅜-mile southwest of the discovery, entered the Ellenburger at 11,064 feet, correlating 32 feet low. Seven-inch pipe was cemented at 11,109 feet, and the hole was deepened to 11,676 feet before making a production test. Testing tool packer was spotted at 11,561 feet. The 115-foot section yielded gas to the surface within one hour, and the recovery consisted of 800 feet of gas-cut mud and 6130 feet of salt water cut with gas. While this water table is more productive it coincides with the first water credited to the discovery. Standifer 1 tested salt water with nominal show of gas at 11,689-791, 11,811-901, and 11,903-92 feet.

Granite was enocuntered by Standifer 1 at 12,492 feet, and penetrated to 12,505 feet. The combined section of Ellenburger and detrital amounts to 1428 feet, as compared with a 1644-foot section of Ellenburger and Cambrian on granite in the nearby Big Lake field.

Four-inch liner was cemented at 11,245-12,505 feet for a decisive check on production possibilities of the Lower Ellenburger. Perforations at 12,000-170 and 12,240-290 feet returned salt water. No perforations were made at levels equivalent to the perforations in the Ellenburger discovery due to recovery of salt water on drill-stem tests.

Having failed to develop production below its water table, Standifer 1 was in process of completion as a gas-condensate producer from Ellenburger perforations at 11,280-370 and 11,430-90 feet. It has more exposed pay than the other completions and is producing higher in the section.

Republic Natural Gas Company's Barnett 1-A-E, two miles north by west of the discovery, logged prospective oil production in the 7500-foot Permian, and favorable showings, based upon samples and electrical formation surveys, in the Pennsylvanian between 9840 and 10,175 feet. The most effective Pennsylvanian pay is credited to the bottom 25 feet. This outpost entered the Ellenburger at 11,580 feet, thereby rating as the second lowest structurally. Seven-inch pipe was cemented at 11,590 feet. First production test of the Ellenburger was made from open hole to 11,640 feet, resulting in 30 feet of rotary mud. At the 11,725-foot level the open hole below 11,658 feet was treated with 2000 gallons of acid. This treatment resulted in the well flowing gas and salt water for seven hours, then the flow ceased. A drill-stem test at 11,737-814 feet yielded 7800 feet of salt water. Republic was drilling below 12,025 feet in dense dolomite to check on production possibilities of the lower zone. This objective is equivalent to the 12,022-162-foot level drill-stem test that returned 420 feet of gas-cut mud without water in the plugged-back Pennsylvanian discovery. Republic will plug back and attempt to make a producer in the top 100 feet of its Ellenburger section if a deeper zone is not present.

An 80-acre spacing pattern has been tentatively adopted in developing the Ellenburger zone. Five producers were confirmed by mid-September, and seven outlying projected Ellenburger tests were under way. The latter will require from one to three offsets, if productive. Late wells have been completed within a range of from four to six months. Costs have been lowered to about $250,000 each due to exceptionally fast drilling time.

Gas purchase commitments assumed by the El Paso Natural Gas Company for marketing in California and intermediate states has stimulated drilling and assures a reasonable market outlet. This firm contracted with the discovery group to purchase a minimum of 20 million cubic feet of gas daily for 25 years and to provide an extension of its system that will consist of about 100 miles of 18- or 24-inch line from Jal, N. M., to the field. The gas sales contract becomes effective October 1, 1949, but if pipe is not available for the completion of the line then producers will be paid $250 per day in the form of a penalty. After May 1, 1950, the purchaser is obligated to take the minimum volume of contracted gas or pay for same at contract price.

Producers will receive the highest price recorded for natural gas sales in the Permian Basin. The gas firm contracted to pay 7½ cents per 1000 cubic feet during the first five years; then 8½ cents and 9½ cents per 1000 cubic feet during the second and third five-year periods, respectively. During the final ten-year period the purchaser will pay the prevailing market price, or a minimum of 10½ cents per 1000 cubic feet.

A development fund of $2 million dollars has been made available to the discovery group by the gas firm to encourage prompt drilling. Producers are to be charged 3 percent interest, and will be permitted to amortize the loan through 25 percent of their gas sales.

El Paso Natural Gas Company will advance the discovery group approximately $3 million for the erection of an absorption type natural gasoline plant for the removal of liquid hydrocarbons and the conditioning of the high-pressure sweet gas for its interstate markets.

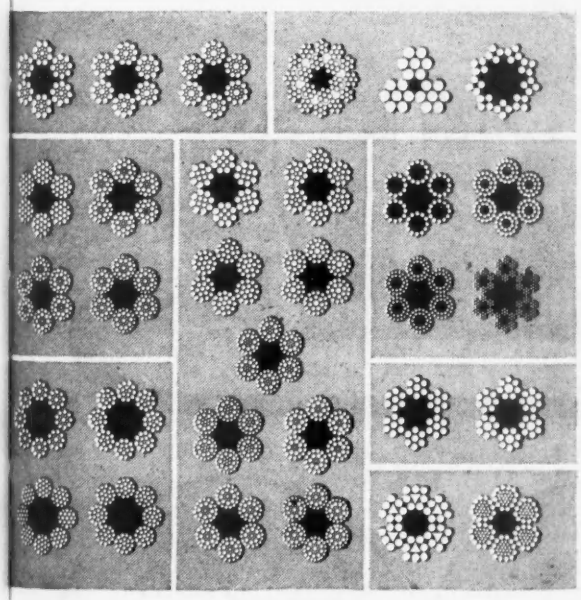
Condensate production is temporarily separated from the gas by use of high-pressure separators. The Ellenburger discovery has been producing about 2 million cubic feet daily in making its special allowable of 500 barrels daily. Production records filed with the Texas Railroad Commission reveal that it has maintained its top allowable through July, latest report available, for a cumulative yield of 112,000 barrels to August 1.

Market outlet for the condensate is provided by Shell Pipe Line Corporation, which entered the field within a month after the completion of the discovery with an eight-inch lateral off its West Texas-Oklahoma ten-inch carrier.

Completed wells and those drilling and projected within the outlined producing contour will enable the field to fulfill its minimum daily gas outlet when contract becomes effective. A gas well is permitted to produce up to 25 percent of its daily potential if properly utilized under state conservation rules, and when classified as such the condensate production is not subject to proration restrictions.

Ellenburger production in the Permian Basin is predominantly low in sulfur content, although a few areas are classed as semi-sweet. The condensate produced in the Benedum area from this zone contains only 0.08 percent sulfur, while distillation tests credited it with an octane rating of 47.

Confidence- WITH ITS SLEEVES ROLLED UP!



STRAIGHT AND STALWART, every factory stack is a towering symbol of man's faith in the future... industry's confidence in its ability to create and to expand production for better living and a richer world.

With confidence like that, Roebling has pioneered in developing and making an extraordinary range of products indispensable to industry. And the confidence that its products and engineering skill have earned in every industrial field is one of Roebling's most valued assets. Every Roebling employee is striving to safeguard that confidence by making products and rendering services that are of maximum utility to you.

YOU CAN'T GO WRONG WITH THE RIGHT WIRE ROPE

EVERY TYPE of Roebling Wire Rope is right for certain service. But that's not enough... the important thing is that you choose the one rope that's *right* for your own job... the rope with the right balance of strength, flexibility, fatigue and abrasion resistance to give real economy over a long period of use.

Your Roebling Field Man will gladly study your requirements, and you can have full confidence that the rope he recommends will give you top returns per dollar. Whatever type it is, preformed or non-preformed, it will have behind it Roebling's unequalled experience in research, development and manufacturing the finest wire products that can be made.

Call or wire the nearest Roebling branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

Distributed by: **The National Supply Company**
Republic Supply Company

ROEBLING

JR ROEBLING

★ *WIRE ROPE AND STRAND* ★ *FITTINGS* ★ *SLINGS* ★ *SUSPENSION BRIDGES AND CABLES* ★ *AIRCORD, AIRCORD TERMINALS AND AIR CONTROLS* ★ *AERIAL WIRE ROPE SYSTEMS* ★ *ELECTRICAL WIRE AND CABLE* ★ *SKI LIFTS* ★ *HARD, ANNEALED OR TEMPERED HIGH AND LOW CARBON FINE AND SPECIALTY WIRE, FLAT WIRE, COLD ROLLED STRIP AND COLD ROLLED SPRING STEEL* ★ *SCREEN, HARDWARE AND INDUSTRIAL WIRE CLOTH* ★ *LAWN MOWERS*

Drilling Prices Fail To Keep Pace with Rising Costs

By WARREN L. BAKER
Editor

FAILURE of prices to keep pace with increased costs has placed the drilling contracting business in a very unhealthy economic state. This same situation existed in 1947, but it has been further aggravated by additional sizeable growth in expenses while drilling prices have advanced by an extremely small amount. Sharp increases in costs during the past year, coupled with previous gains in the preceding two or three years, make present drilling operations far more costly than prewar levels. Yet contractors are receiving just slightly more for their work than they did in 1941.

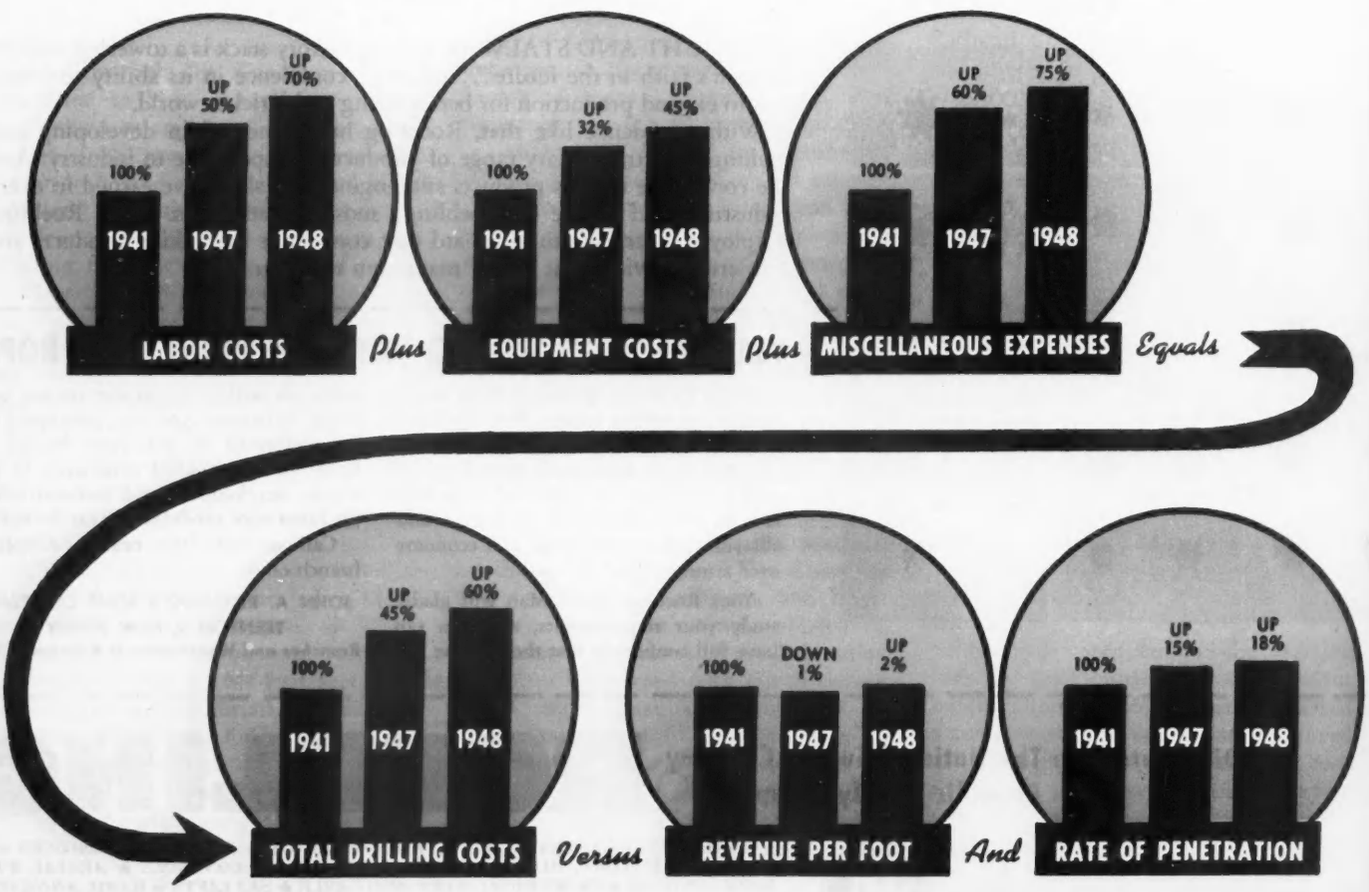
For the U. S. as a whole, total or overall daily drilling costs for rotary rigs now are 60 percent greater than in 1941 and even 15 percent higher than in 1947. In contrast, drilling contractors' revenue per foot of hole drilled is up only 2 percent since 1941. While this represents a slight improvement over 1947, when revenue per foot drilled was 1 percent less than in 1941, the increase in drilling prices the past 12 months failed to come anywhere close to approximating the growth in expenses. During the past year, drilling prices advanced only 3 percent in the face of a 15 percent gain in costs. Hence, economically, drilling contractors are in a worse position today than the very unfavorable situation of a year ago.

Drilling contractors to some extent—but only partially—have been able to offset the growing margin between cost and income by increased efficiency. The average rate of penetration (speed of making hole) in the U. S. today is about 18 percent faster than in 1941, whereas in 1947 it was 15 percent better than in 1941.

If these conditions continue, the efficiency of the drilling business will deteriorate. The large investments necessary to purchase drilling rigs today make it necessary that there be a satisfactory profit incentive. Unless this is true, the inevitable result will be the liquidation of the physical assets into cash, and drilling equipment will become obsolete and worn out.

The drilling business is so essential to the oil-producing division of the petroleum industry that the latter has a distinct stake in seeing that drilling contractors remain a healthy, efficient arm. The high percentage of wells being drilled by independent drilling contractors is ample proof of the essential position they now occupy in the industry. Eighty-two percent of the rotary rigs are owned and operated by independent drilling contractors, and approximately 500

Increase in United States Drilling Costs Since 1941 vs. Trends in Revenue and Penetration Speed



Trends In Drilling Costs and Revenue

(1948 and 1947 compared with 1941 level)

PERMIAN BASIN

	1941	1947	1948
DRILLING COSTS:			
Labor Costs	100%	155%	170%
Equipment Costs	100%	133%	146%
Miscellaneous Expenses	100%	165%	177%
Total Drilling Costs	100%	150%	161%
Revenue per Foot Drilled	100%	98%	103%
Rate of Penetration	100%	125%	125%

TEXAS-LOUISIANA GULF COAST

	1941	1947	1948
DRILLING COSTS:			
Labor Costs	100%	150%	170%
Equipment Costs	100%	133%	145%
Miscellaneous Expenses	100%	164%	174%
Total Drilling Costs	100%	145%	160%
Revenue per Foot Drilled	100%	102%	103%
Rate of Penetration	100%	118%	118%

UNITED STATES

	1941	1947	1948
DRILLING COSTS:			
Labor Costs	100%	150%	170%
Equipment Costs	100%	132%	145%
Miscellaneous Expenses	100%	160%	175%
Total Drilling Costs	100%	145%	160%
Revenue per Foot Drilled	100%	99%	102%
Rate of Penetration	100%	115%	118%

OKLAHOMA-KANSAS

	1941	1947	1948
DRILLING COSTS:			
Labor Costs	100%	145%	165%
Equipment Costs	100%	132%	144%
Miscellaneous Expenses	100%	160%	170%
Total Drilling Costs	100%	145%	155%
Revenue per Foot Drilled	100%	99%	101%
Rate of Penetration	100%	118%	118%

CALIFORNIA

	1941	1947	1948
DRILLING COSTS:			
Labor Costs	100%	155%	171%
Equipment Costs	100%	135%	146%
Miscellaneous Expenses	100%	165%	180%
Total Drilling Costs	100%	150%	165%
Revenue per Foot Drilled	100%	98%	101%
Rate of Penetration	100%	115%	117%

contracting firms are engaged in the rotary drilling business.

A number of contractors feel that the cost figures presented here are too conservative and that current expenses are actually another 5 to 10 percent higher. This proved true of a similar study published in WORLD OIL a year ago this month. Therefore, to present a proper comparison between drilling costs of today and a year ago, figures published a year ago for 1947 have been revised upward where they were found to be too low.

Major factors in the trend toward higher drilling costs are (1) higher costs of wages, equipment and operating expenses; (2) greater depth of wells; and (3) the larger proportion of exploratory or wildcat wells being drilled.

Labor costs on rotary rigs, which account for approximately one-third of the expense of drilling a well, are up 70 percent in 1948 for the nation as a whole from the 1941 level, having risen 20 percent from the 1947 rate which was 50 percent higher than in 1941. Individual wages are not up 70 percent since 1941, but it is costing about 70 percent more for labor to drill a well than in 1941. It is a general practice now, for example, to pay crews during cementing operations, and the time required to drill a well has increased because of greater average depths.

Equipment costs today are 45 percent higher than in 1941 and 13 percent greater than a year ago. This is an important increase to the drilling contractor, since equipment expense accounts for about 45 percent of all his expenditures. The weighted average increase for stock items has not been quite 45 percent, but many engines, drawworks, and other pieces of equipment have been changed or improved to an extent which makes new models cost up to 75 percent more than old models.

Miscellaneous expenses have increased sharply, due to greater moving costs, longer time in getting on the job, more complete insurance coverage, and a dozen other expense services incidental to oil well drilling. Trucking costs are way up and, in addition, it frequently takes much more time to move than it did during 1941 when trucks were readily available and drilling equipment was not as bulky nor as heavy as today. In contrast with 1941 levels, miscellaneous drilling expenses today are 75 percent higher and are up 15 percent over last year.

With more of the rotary drilling concentrated in deep areas, increased depth is a factor contributing heavily to higher costs. Despite improved equipment and faster drilling speed, it still costs about three times as much to drill a 10,000-foot well as a 7000-foot well, and a 14,000-foot well is nearly ten times more expensive than one of half that depth. The biggest single factor which causes costs for deep drilling to soar is time. Below 7000 feet, making hole becomes progressively more difficult. Drilling speed decreases 40 percent between 8000 and 9000 feet and even more as the bit bores farther down. Time affects cost because most items of drilling expense are related to time. For example, much more time is required for non-drilling operations such as round trips with the drilling string and surveys of the hole. Labor costs per well increase sharply under such conditions. Not only does extra time involve more fuel and supplies, but repair and maintenance costs rise due to the heavier tasks performed in hoisting and rotating the drilling string.

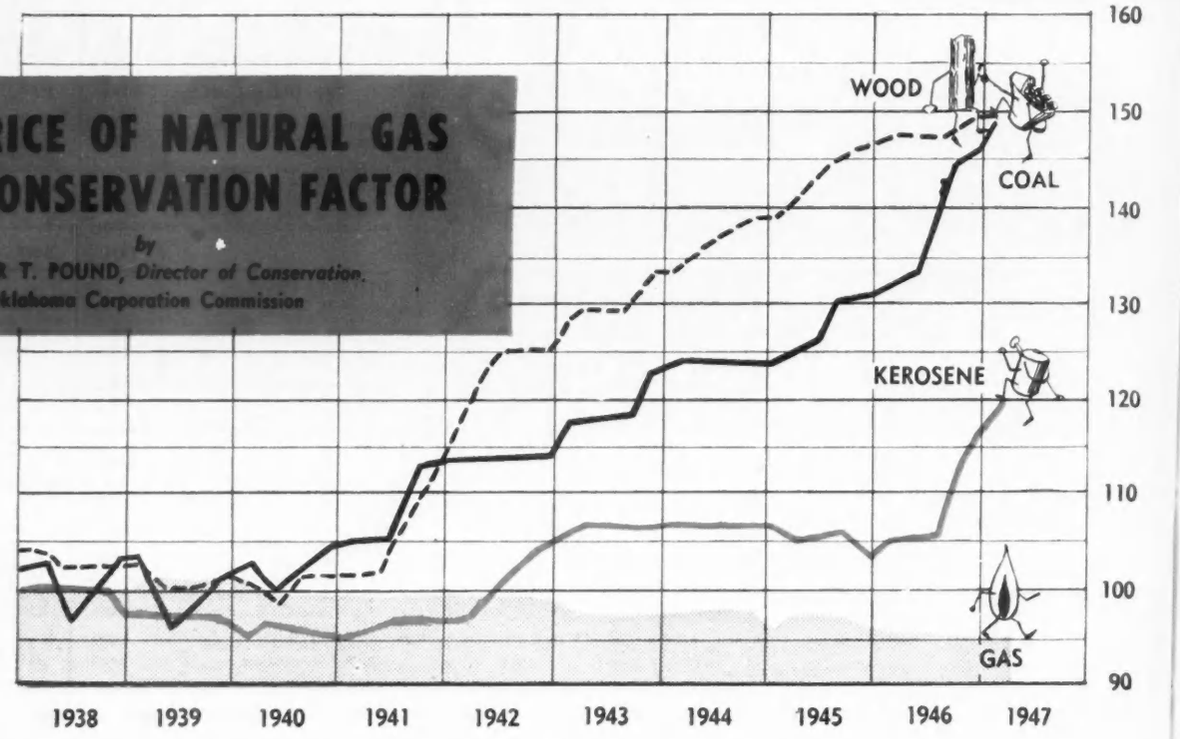
Some of the increased costs being experienced by contractors are due to the greater number of wildcat wells being drilled. Wildcat wells cost much more than field wells, due to the greater amount of coring and survey work required, and because of the delay born of caution necessary when little is known about formations to be penetrated. Seventeen percent of all wells drilled during the first half of 1948 were exploratory wells, while only 10 percent were wildcats during the year 1941.

Much of the trouble appears to lie among the contractors themselves in taking work at too low prices. Despite the large number of wells being drilled, there is a surplus of about 300 rigs. Some of a contractor's overhead expense continues even when a rig stands idle and he knows he may have trouble getting his men back if he discharges them. Consequently, some contractors are willing to take a job at low rates to keep their crews together. Finally, however, this low price will set the rate for future work.

Whatever the reason, the inevitable result, as stated before, will be a deterioration in drilling efficiency. This will be harmful to oil producers as well as drilling contractors.

THE PRICE OF NATURAL GAS AS A CONSERVATION FACTOR

by
WALKER T. POUND, *Director of Conservation,*
Oklahoma Corporation Commission



Price of gas for household cooking and water heating is down, while prices of competitive fuels have risen.

IN CONSIDERING the effect of the field price of natural gas as a factor in its conservation, the same factor with respect to oil, and particularly with respect to the gas produced with oil, should not be disregarded.

The two periods during which probably the greatest waste of both oil and gas occurred in the Southwest, and certainly in Oklahoma, were periods in which crude oil commanded the lowest price in history and natural gas field prices were constantly declining. The two periods referred to are those covering the development of the Glenn, Cushing and Healdton pools, and the time of the discovery and development of the Seminole, Oklahoma City, and East Texas pools. Waste—of all types—of both oil and gas was probably greater during those two periods than at any time in the history of the petroleum industry. The two periods were not without their benefits, however, for each was followed by the enactment of conservation laws designed to correct the evils experienced.

During the first of these periods, crude sold for 50 cents a barrel, and gas, rather than having any value, was in most instances worth less than nothing—was regarded in fact as a nuisance. Reliable figures on wellhead prices for natural gas are not available for this period, but two and one-half cents per thousand cubic feet was probably the top.

An order issued by the Oklahoma Corporation Commission in 1915 found that not more than 10 percent of all the gas produced in the Cushing field was utilized and that during 1913-14 and the first half of 1915, 200 billion cubic feet of gas was wasted in that field. This amount of gas at two and one-half cents per thousand at the well represents $5 million and at 25 cents per thousand—the price at which gas sold for domestic use—it is $50 million worth of gas.

We all remember the waste of oil and gas in the Oklahoma City field, where at one time one well alone was venting 75 million cubic feet of gas a day to produce 17,000 barrels of oil. Assuming a price of a dollar a barrel for oil (this was in 1929) and five cents per thousand for the gas, the gas vented was worth twice as much as the oil saved. As a matter of fact, neither oil nor gas commanded any such price for very long after 1929. Oil soon dropped to 10 cents a barrel, and gas was again worth nothing. During one two and a half year period the Oklahoma City field vented an average of 225 million cubic feet of gas daily or a total of over 200 billion, more than twice the amount of gas used in the entire state for all domestic and industrial purposes during the same period of time.

FIELD PRICES for natural gas are in general extremely low, especially in the major producing areas of the Southwest, where the nation's reserves are heavily concentrated.

These low prices have resulted in waste of natural gas and have impeded conservation of this resource. The low prices thereby have adversely affected the interests of the general public as well as producers, royalty owners, and the producing states.

Better field prices are necessary to encourage conservation, to reduce waste, and to stimulate discovery of new gas reserves.

The history of field prices in the petroleum industry definitely indicates the effect that such prices have on conservation. Field price trends for crude oil and natural gas have followed roughly a parallel pattern although natural gas prices have as a rule lagged behind crude prices. The slowness of natural gas field prices to advance in line with crude petroleum and other fuels has been attributed to several different causes. For one thing, natural gas, unlike oil and other competing fuels, is generally sold at its source under long term contracts. This practice has become increasingly prevalent during the past few years. This is particularly true of gas transported and sold under certificates issued by the Federal Power Commission. Strong arguments can, of course, be advanced for the necessity of such contracts by gas purchasers. The fact remains, however, that there has been, and continues to be, a marked re-

luctance on the part of gas purchasers to purchase on terms which would promote conservation.

The gas industry will argue that the law of supply and demand, if permitted to function without interference, is all that is necessary. This argument will not hold water. The regulation of burner tip prices at one end, coupled with the strong bargaining position of gas purchasers—particularly in the absence of effective ratable taking laws—have not in fact permitted the law of supply and demand to freely operate. The effective enforcement, and the gradual acceptance on the part of industry, of the principles of ratable taking during the past few years have had a great deal to do with the slight upward trend in field prices in the Southwest and the trend has certainly been in the direction of more uniform prices.

In the past it was a common practice of competing pipe lines—where necessary—to bid against each other for gas, not on a basis of higher prices but by one purchaser agreeing to take twice as much gas as the neighboring operator was selling—without regard of course to the correlative rights involved. Fortunately such practices have become obsolete.

There is still much to be desired. The average field price of gas in the Southwest was approximately four and one-half cents in 1922; by 1940 it had dropped to almost two cents per thousand cubic feet. Since then, the trend has been upward. In 1945 (the latest figures available by the U. S. Bureau of Mines) the average had reached two and one-half cents per thousand, still two cents below the average for 1922. The trend is, however, still upward. The average wellhead price for all gas produced in Oklahoma in 1947 was approximately four cents. Compare this to the trend in the Appalachian area for the same period, where the average rose from slightly over 14 cents in 1922 to almost 18 cents in 1945. The national average for the same period went from 11 cents to four and one-half cents.

Such trends if continued indefinitely would inevitably result in the destruction of the independent gas producer, and, for that matter, the entire gas industry. Gas pipe lines must have access to reserves. Yet, I know of but two wildcat wells drilled in Oklahoma in the past five years in search of gas.

In the past, any exploration resulting in gas was regarded by the operator as at best a "consolation prize." He could choose between it and the "booby prize" or dry hole. All too often it was financially advantageous for him to choose the latter.

There can be no question but that depressed field prices have resulted in the abandonment of many such discoveries as well as producing properties causing the waste and permanent loss of important gas reserves.

About the Author

WALKER T. POUND has been associated with the oil industry for 18 years, about half of which have been spent in oil and gas conservation work in Oklahoma. Pound went to work for Shell Oil Company in 1928 at Wink, Texas, as a roustabout, and the following year was transferred to the Hobbs, N. M., field. Wasteful production practices in the Wink area as compared with the methods applied in the Hobbs, N. M., field sold Pound on the benefits of conservation and he has "preached the gospel" ever since.

The field price of gas is like the weather—everybody talks about it but no one does anything to change it. There is of course one notable exception to this statement. I refer to Orders No. 19514 and 19515 issued by the Oklahoma Corporation Commission on December 9, 1946. The orders were issued—and I quote one of the findings:

"For the purpose of preventing waste, economic and physical, of natural gas, for the purpose of protecting correlative rights, and to insure the greatest ultimate recovery of natural gas from the common reservoir involved, this Commission should not permit natural gas to be taken out of the producing formations in the Guymon-Hugoton field at a price of less than seven cents per thousand cubic feet of natural gas measured at a pressure of 14.65 pounds, absolute pressure per square inch."

The natural gas investigation by the Federal Power Commission reflects an almost unanimity of opinion that field prices for natural gas are too low. The report reads in part, as follows:

"The record of testimony (in this case) discloses a general accord among producers of natural gas, royalty owners, some pipe line companies, and state regulatory and conservation agencies of producing states that field price levels are too low, especially in the major producing areas of the Southwest. This view is supported with evidence showing the adverse effects of these prevailing prices upon the natural-gas industry, and upon the economies of the producing states and the nation."

And again: "Dissatisfaction with field prices in the areas of major supply also stems from the conviction that existing levels tend to (1) hamper the producing states in the work of conservation, (2) retard exploration for gas and the development of additional reserves, and (3) adversely affect the economic well-being of producers, royalty owners, and producing states."

Prominent economists have pointed out that gas is, and has been, selling in the field for less than its replacement cost and for much less than its relative value in terms of other fuels. For example, natural gas at four cents per thousand is the equivalent of coal at less than a dollar a ton or oil at 22 cents a barrel.

The position of southwestern state regulatory officials was most aptly stated by Col. E. O. Thompson, chairman of the Texas Railroad Commission, when he said:

"An increased field price for gas would be the greatest conservation measure that could be adopted. We would hear no more discussion of end use, competing fuels, or necessity for additional conservation rules and regulations. Price is the control. When a commodity begins to have an increasing market value, self-interest comes into play and the owners themselves begin to put forth the proper effort to prevent waste."

As stated above, almost all witnesses in the Federal Power Commission hearings—if they expressed any opinion—said that higher field prices for gas were desirable. Many of the witnesses were of the opinion that higher field prices could be paid with but little, if any, advance to the consumer.

R. J. Gonzalez, economist of the Humble Oil & Refining Company, states that: "The important point . . . is that the average price paid for gas at the well is only about 18 percent of the delivered cost to domestic, commercial and industrial consumers.

"An increase of one cent per M.C.F. at the well, which would be 40 percent on the 1944 price in Texas, would mean only about three percent higher cost if passed directly on to these users."

E. Buddrus, president of Panhandle Eastern Pipe Line Company, has said that:

"I believe the added cost for gas as a commodity will be insignificant in its effect on the ultimate consumer. During 1946, the average annual use of natural gas per residential customer was 70,000 cubic feet. If the wholesale price was increased one cent per thousand as a result of higher field prices, and all of the

■ CONTINUED ON PAGE 60

New Oil-Using Units Enlarge

Petroleum Demand

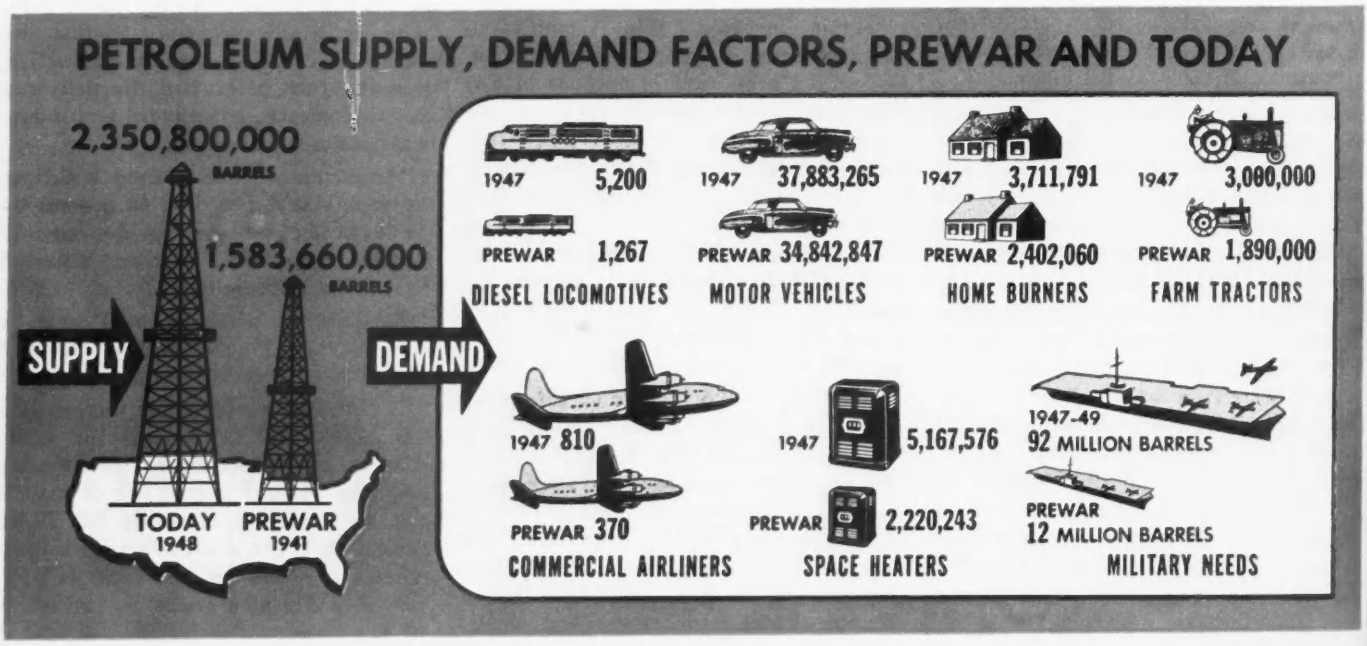
IMPORTANT factors contributing to soaring U. S. demand for oil products are pointed out in a 12-page pamphlet lately published by the Oil Industry Information Committee under title, "Current Facts on Petroleum Supply and Demand." The report cites Bureau of Mines estimates that total demand on the U. S. industry, including exports, will average 6,328,000 barrels daily in 1948, an increase of 7.3 percent over the demand in 1947, and that domestic demand will average 5,935,000 barrels daily, up 8.9 percent.

Total demand for gasoline, including exports, is estimated at 2,494,536 barrels daily in 1948, up 31.4 percent from 1941 and up 8.4 percent from 1947. Increased registration of motor vehicles are shown to be one reason for the rise in gasoline use. Total registration of privately-owned motor vehicles as of December 31, 1947, were 37,402,230, a new high record. Publicly-owned vehicles (federal, state, and municipal government) added 481,035, lifting the total to 37,883,265 vehicles, an increase of 3,510,263 or 10.2 percent compared with the end of 1946 and 8.7 percent compared with the end of 1941, last prewar year of the U. S.

U. S. industrial production in 1948 has averaged 189 percent of the 1935-1939 average, compared with 187 in 1947 and 162 in 1941. Consequently, there is heavy demand for residual fuel oil and industrial lubricating oil, while demand for other products also is stimulated. If this high production continues, demand for lubricating oils will be 7 percent greater in 1948 than 1947. Residual fuel oil is used by ships and industry. Demand is expected to average 1,471,311 barrels daily in 1948, up slightly from 1947 and up 34.9 percent from 1941.

Prospering farmers have been purchasing new tractors, stationary engines, and other tools that consume large quantities of gasoline, burning oils, diesel oil, lubricating oils, and other petroleum products. Farmers received 10.5 percent of the national income in 1947 compared with 8.1 percent in 1941. The 3 million tractors now in use on farms will consume an estimated 2850 million gallons of gasoline, tractor fuel, or diesel oil in 1948, compared with 1644 million gallons used by 1,890,000 tractors in 1941, an increase of 73 percent in seven years. Adding to oil use on the farm are various other factors. About five tools, on average, are used in combination with each tractor on farms. In addition, there are over 1,200,000 other oil-powered engines on farms, including 900,000 stationary engines and 300,000 mounted engines, all consuming oil products. Self-propelled combines, using petroleum products, increased to about 10,000 in 1947 from 3539 in 1945, an increase of 183 percent. There are now about 9000 airplanes used in agriculture, compared with about 100 in 1941.

Installations of oil burners for central heating in homes and small stores have skyrocketed since the end of the war. Such installations were estimated at 3,711,791 as of March 1, 1948, up 31.6 percent from the 2,821,044 at the end of 1946 and up 54.5 percent from the 2,402,060 installations at the close of 1941. In addition, there were 370,566



BAASH-ROSS TOOL CO.

Baash-Ross News

BAASH-ROSS TOOL COMPANY • LOS ANGELES • HOUSTON • OKLAHOMA CITY • NEW YORK

OUR 28th YEAR

Now available in TWO TYPES...

The BAASH-ROSS POWER SWIVEL

Constant speed — Constant torque
Variable speed — Variable torque

Complete...

No Rotary Table or Auxiliary Equipment Necessary!

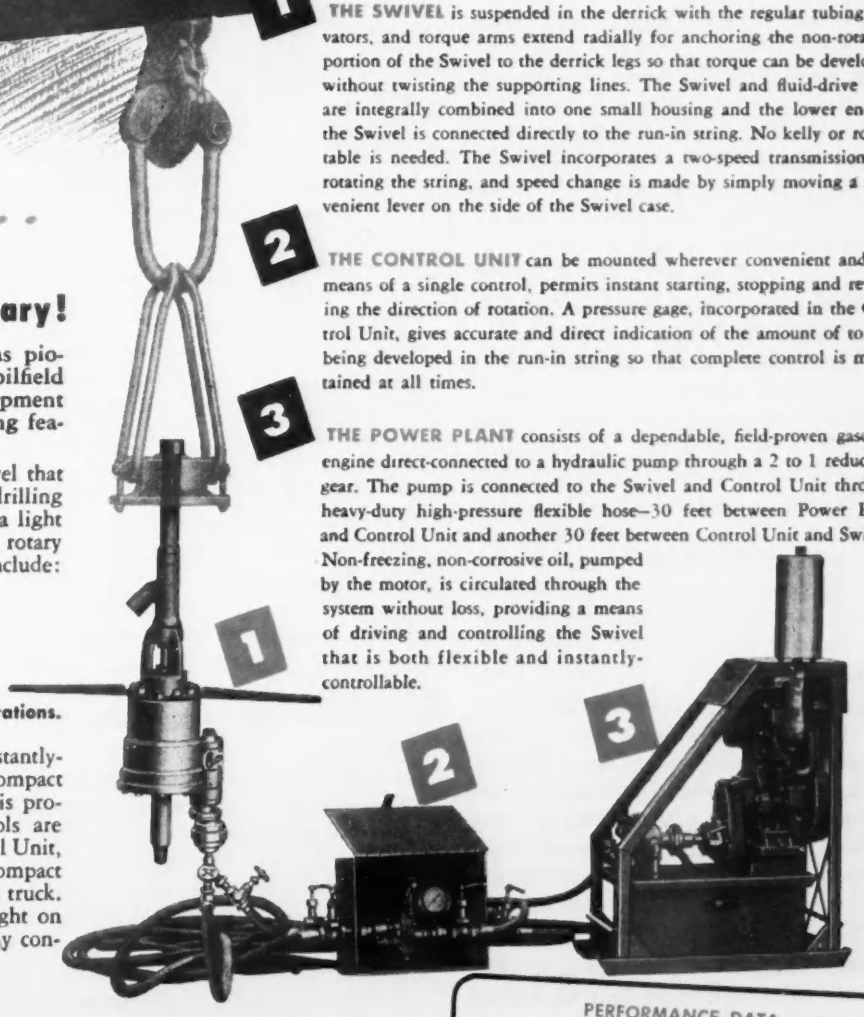
From the same organization that has pioneered so many important advancements in oilfield equipment, comes another *really new* development that has many unique money and time-saving features. It is the Baash-Ross Power Swivel.

This unit consists of a fluid-driven Swivel that can be suspended in the rig—*any* rig, whether drilling or producing—to provide a means of rotating a light string of tools without need for installing kelly, rotary table or other heavy equipment. Applications include:

- **Internal cutting and fishing jobs**
- **Drilling out bridges**
- **Scraping liners**
- **Drilling out cement in tubing**

. . . and other similar operations.

The Swivel is driven by positive, instantly-controlled hydraulic pressure generated by a compact Power Unit, and continuous finger-tip control is provided by a Control Unit in which all controls are centralized. The entire assembly—Swivel, Control Unit, Power Plant and connecting equipment—is so compact it can be readily transported in a small pick-up truck. And if desired, the Power Plant can be left right on the truck for quick jobs—or can be set off at any convenient place on or near the rig.



1 **THE SWIVEL** is suspended in the derrick with the regular tubing elevators, and torque arms extend radially for anchoring the non-rotating portion of the Swivel to the derrick legs so that torque can be developed without twisting the supporting lines. The Swivel and fluid-drive unit are integrally combined into one small housing and the lower end of the Swivel is connected directly to the run-in string. No kelly or rotary table is needed. The Swivel incorporates a two-speed transmission for rotating the string, and speed change is made by simply moving a convenient lever on the side of the Swivel case.

2 **THE CONTROL UNIT** can be mounted wherever convenient and, by means of a single control, permits instant starting, stopping and reversing the direction of rotation. A pressure gage, incorporated in the Control Unit, gives accurate and direct indication of the amount of torque being developed in the run-in string so that complete control is maintained at all times.

3 **THE POWER PLANT** consists of a dependable, field-proven gasoline engine direct-connected to a hydraulic pump through a 2 to 1 reduction gear. The pump is connected to the Swivel and Control Unit through heavy-duty high-pressure flexible hose—30 feet between Power Plant and Control Unit and another 30 feet between Control Unit and Swivel. Non-freezing, non-corrosive oil, pumped by the motor, is circulated through the system without loss, providing a means of driving and controlling the Swivel that is both flexible and instantly-controllable.

TWO TYPES...MANY APPLICATIONS

To meet the various requirements of different operators, the Baash-Ross Power Swivel is available in two types . . .

1. **MODEL "F" which provides a choice of two rotating speeds as indicated at right, and in each speed both the torque and RPM remain practically constant at all times.**
2. **MODEL "FV" which provides two speed *ranges*, and in each range both the torque and RPM are variable between wide limits as indicated at right.**

Since the Power Swivel requires no drawworks or other heavy equipment that is complicated and costly to install, it is ideal for many light rotating jobs—for drilling out cement plugs and sand bridges, for scraping paraffine, for rotating internal cutters, etc.

On cutting jobs its smooth, sensitive, easily-controlled hydraulic drive is far superior to the irregularities and uneven feed of manual rotation. It is also safer because there is no need for workmen to be near the stretched pipe while it is being cut . . . nor for them to work on makeshift platforms. The Power Swivel can be operated at any height in the rig, eliminating need for cutting off the run-in string at floor level.

PERFORMANCE DATA

- **Swivel** Capacity—80,000 lbs. Tensile Loading.
- **Speed** Model "F", 17 RPM—constant—low speed
  34 RPM—constant—high speed
  Model "FV", 1 to 17 RPM—variable—low speed.
  1 to 34 RPM—variable—high speed.
- **Torque** Maximum—both models . . . 15,000 inch-lbs.
  Elevator Neck—2⅞" O.D.
  Lower Stem Joint—2⅜" API Regular Pin.
  Goose Neck—2" API Line Pipe (female thread).
- **Power Unit** 4 cycle gasoline engine, 9.2 h.p. at 2200 RPM, geared 2 to 1 reduction.
  Magneto, spark plugs and wiring all spark-proof—exhaust protected with spark arrestor.
  Pump equipped with safety valve for 1000 p.s.i. maximum pressure.
  Sump Capacity—20 U. S. gallons.

Write for full details
—or see your Baash-Ross Representative

commercial heating installations at the end of 1947, latest available figures showed.

Use of diesel engines has been sharply increased by railroads, industry, busses, and trucks. Exclusive of those for military use, there were 137,000 diesel engines in use at end of 1947, with horsepower of 57,851,000. Including many diesel-electric locomotives put into service since beginning of this year, these diesel engines will require over 75 million barrels of fuel in 1948, an increase of over 200 percent since 1941. Diesel-electric locomotives in use on railroads were estimated at 5200 at end of 1947, an increase of about 300 percent over the 1267 units in 1941.

Requirements of all kinds of oil products for the military in the fiscal year ended June 30, 1948, were estimated at 80,073,999 barrels, or 219,380 barrels daily, from the U. S. and from American companies in the Caribbean area. While those needs are considerably below those at the peak of the war in 1945, they are almost seven times the needs of ten years ago—prewar—when they approximated 12 million barrels per year. For the fiscal year to end June 30, 1949, military requirements are estimated at 92,229,000 barrels or an average of 252,682 barrels daily.

Gas oil and distillate fuel oil demand, which includes the lighter types of fuel oil used for home heating, gas enriching purposes and diesel engines, is estimated at 1,045,082 barrels daily in 1948, an increase of 16.6 percent compared with 1947 and 101.6 percent compared with 1941. Kerosine demand is estimated at 336,066 barrels daily, an increase of 12.1 percent over 1947 and 69.2 percent over 1941.

Sales in 1947 of liquefied petroleum gas, the "bottled gas" used by consumers in rural and small town areas and by public utilities, chemical, and manufacturing industries, approximated 1845 million gallons, up 30 percent from 1946, 73 percent from 1945, and 299 percent from the 462,852,000 gallons used in 1941.

Space heaters, used for central heating and for single room heating, totaled 5,167,576 at end of 1947, up 133 percent from the 2,220,243 used at end of 1941. Each uses an average of 650 gallons of kerosine or No. 1 distillate fuel oil per year.

Demand for aviation gasoline averaged 73,000 barrels daily in 1947, compared with only 41,000 daily in 1946, an increase of 79 percent. In the first four months of 1948 the demand approximated 94,200 barrels a day, compared with 43,900 daily in the corresponding period a year previously.

Price of Natural Gas as A Conservation Factor

• CONTINUED FROM PAGE 57

increase passed directly to the consumer, the additional cost would amount to 70 cents a year, or less than six cents a month."

And to use my own figures, an increase of five cents per thousand cubic feet would cost the average consumer less than a penny a day.

To quote Mr. Buddrus' statement further: "I believe the public interest lies in a long pull, abundant supply even though it may cost a few cents more per month. With respect to the industrial consumers, in practically all cases, use of natural gas is competitive with coal, oil, and electricity, and I am sure that competition from these other fuels will amply protect the interest of the industrial consumer . . . and the real question is whether the consumer would ever be charged any greater price for its gas."

On another occasion, Mr. Buddrus states that "Compared to the average coal and fuel oil equivalents along our line, 10 cents a thousand added to our industrial gas wouldn't hurt us, wouldn't cause us to lose a great deal of business."

One of the principal causes advanced for low field prices has been the policy of rate making agencies and particularly the Federal Power Commission of using the original cost standard as applied to gas producing properties owned by regulated pipe lines.

The February report of the Federal Power Commission—subscribed to by Commissioners Smith and Wimberly—indicates that at least those two members of the commission are of the opinion that prices should be increased and I quote from their conclusions and recommendations:

"There is evident a widespread dissatisfaction with existing levels of field prices for natural gas, particularly in the major producing areas of the Southwest where the nation's reserves are heavily concentrated. It is apparent, too, that extremely low field prices in areas of major supply have impeded the conservation of this resource in the general public interest, and that the economic interests of producers, royalty owners and the producing states generally have also been affected adversely by these conditions."

It further appears that at least two members of the Federal Power Commission are prepared to abandon the original cost standard. And I again quote from a recommendation in the report:

"The thorough examination of this matter, which was thus made possible on a more comprehensive basis than had been afforded in the narrower setting of particular rate cases, has served to reveal certain important defects of the cost standard as applied to gas production by regulated pipe line companies and their affiliates. On the basis of these considerations, as presented and analyzed herein, it is concluded that a standard of fair field price or reasonable value, which will make appropriate allowance in each instance for the value of such gas as a commodity, should instead be adopted and applied, subject to appropriate safeguards against abuse, in dealing with this problem."

The adoption of such a policy by the Federal Power Commission as above outlined would almost certainly have a beneficial and highly desirable effect on gas field prices. Interstate gas pipe line companies can hardly be censored for not being overly anxious to pay others higher prices when their own gas has in some instances been valued at zero for rate making purposes.

Now since everyone—land and royalty owners, producers, purchasers, and state and federal officials—are all in agreement on this subject—the question is—What shall be done about it? I know of no public official, state or federal, who wants to regulate just for the fun of regulating. I know of no one who wants to see field prices of natural gas fixed by any state or federal agency except and until all other methods have failed. The natural gas industry should remember that neither the enactment of state conservation and ratable taking laws nor of the Natural Gas Act—all of which have meant unwelcome regulation to some in the industry—was brought about by the efforts of the agencies delegated authority under those acts. The enactment of all such laws was the natural and inevitable result of abuses resulting from unwise and shortsighted policies of petroleum pipe line companies. If state and federal agencies are therefore willing—and it certainly cannot be assumed that they are unwilling—to consider proper and necessary advances in field prices of natural gas—when allowing where necessary higher consumer rates—it appears that this problem can be solved.

It would be an indictment of everyone concerned if it is not solved—solved by cooperative effort, and solved quickly. Some will point to the fact that the trend in gas prices is upward, which is true, and certain benefits are already being experienced as a result of that trend.

The fact remains, however, that prices have not advanced enough to sufficiently encourage real conservation, and under present price trends are not likely to do so for several years to come. In the meantime, waste will continue, and conservation will be difficult to accomplish.

An adequate price is still the best conservation agent the industry knows.

THE ECONOMIC EQUATION OF PUBLIC AND LABOR RELATIONS

By KARL L. ELLIOTT
Treasurer and General Sales Manager, Acme Fishing Tool Company, Parkersburg, W. Va.

PUBLIC relations and labor relations are so close akin and interknit that they become inseparable in any analysis of what is good or bad in either case—even though the analyst dare shut one (mind's) eye and look at his public and then take a like (narrow) perspective of labor.

Nor can he deal with public or labor relations—separately or together—without at once running headlong into what is sound or cockeyed economics.

Sound economics—as a science—compells that he recognize all contributing factors and the long range consequences of each. It is, in other words, a case (or science) of when considering the effects of any projected policy designed to benefit some special interest (any segment of the public, including labor, most assuredly) for either the long or short haul, that first shall be taken into full-perspective account the effects of said policy upon the general interest over the long-pull. Otherwise it is quite apt to result in cockeyed economy of the rankest political-tampering type.

On the premise that most any likely-to-become involved or controversial subject may be reduced to, or made clear by, a simple formula, let us use only grass-roots examples to establish the inseparable phase of our public and labor relations thesis:

Let's look in on a typical community and say it is supported largely by oil production and its affiliates. (It might as well be steel, coal, automobiles, rubber, furniture, cotton, cattle, corn or what have you.) Oiltown's people, like those of Coaltown, Rubbertown, etc., etc., are peaceably engaged in the various pursuits which provide livelihood, only most of the wage and salary workers are on payrolls derived more or less directly from oil. Even the merchants and professional people here (to say nothing of politicians, et al) favor larger payrolls. All are keen to see Oiltown boom—and especially to improve their own lot and holdings. Business is good now and everybody should be happy but they aren't quite satisfied. They want more of what it takes and the way thereof is to get more Cash.

So, Oiltown's payroll workers get together—in spirit, if not in the townhall or labor quarters—and demand and get, by ultimatum or strike, a round of raises. Thus the "old burg" booms some more. Is everybody happy now? Just wait and see!

Yes, more CASH is in evidence—both in pay envelopes and, consequently throughout the community. All to the good, including the (local) public. But to provide this additional CASH distribution, Oiltown's employers must, to remain sufficiently solvent to pay wages, raise prices to their customers (a preponderant most of whom are broadcast over America—in Steeltown, Coaltown, Cattletown, etc). "But that's just dandy," says Oiltown. "They can't do without our products; and soon, we'll be 'sitting pretty' for another pay-boost."

Then Coaltown's payroll workers, falling for Oiltown's policy—if not yet pinched and piqued by the higher prices of petroleum products—get together, in spirit and organized bodies, and demand a like policy. Up goes the pay-scale; up the CASH distribution throughout the community; up production costs; and, up the price of coal to the public—everywhere, not overlooking Oiltown, of course. However, we have both Oiltown and Coaltown 'sitting pretty' now. But if the policy is good for them, why not equally so and necessary for all the others? So, each in turn—or mass attack—demands and gets pay-boosts and, by like token, begets price-hikes, until they cover everything under the sun.

Back in Oiltown, what do we find? (Not that Oiltown, really, started all the "rumpus" but it serves our hypostasis. The fact remains, it was started someplace and what seemed a sane policy to and for its original projectors, took hold elsewhere—everywhere—like a prairie fire, and there's no stopping it.)

But back in Oiltown—which scene can be shifted, at will, to every other locale, by now—the public is up in arms: Holding protest meetings—round the dinner-table, if not in townhall—over the high and still higher prices they are paying for Othertown's products. Moreover, they are warning their congressmen that if something isn't done—quick—to relieve the unbearable situation that they, the "long-suffering public," will "take the law into their own hands." And do what, pray? Pull a strike—an all-out buyers' strike—that's what! Then, just where will all these Othertown high-price "artists" get off?

And who do we find among the ringleaders and comprising a preponderant most of those doing the protesting? Why, they are of and for the public, naturally, but who and where were they, months ago, when was set in motion the backyard whirlwind which soon assumed such terrifying, uncontrollable hurricane proportions? No other than (please note carefully) the same payroll workers who were present at those earlier "meetings," where demands were made—and won—for more CASH and concessions without guaranteeing commensurate productivity.

Now, if they—in their duo-role—do join the threatened buyers' strike, they will "Kill the goose that lays the golden eggs." If they strike against Othertown's products, whose producers will use the same bludgeon on Oiltown's—there will follow, as surely as rain, a depression, mass unemployment, want, turmoil, new deal nostrums and "growing-pains" of Communism, such as the 1929 crash unloosed.

Thus, isn't our picture clear? Simply that "We the People" are, almost wholly and irrevokably, "We the Workers?" By providing the demand—the growing markets—for Othertowns' products, we, the workers, are creating and insuring our own jobs. And the prices we must pay, on the one hand, are, of economic necessity and in direct ratio, controlled by what we demand shall go into our pay envelopes—in exchange for more, the same or less productivity.

What can be done to help find and maintain a safe equillibrium? Fair prices—fair pay—fair profits: these three being essential to a sane American way of economic life! Well, that's the $64.00 question. But we, at Acme, are resisting cost increases as medical science does a deadly, epidemical virus. And, in our own unobtrusive way, we shall continue to point out to our employes that "Public Relations and Labor Relations are one and the same," in the final analysis. We shall caution them that they—in their duo-role—are subject to all the consequences which they, as workers, may help bring upon themselves.

Stanolind Collects Safety Dividends

By ANTHONY GIBBON,
Staff Writer

Safety markings on Stanolind seismograph recording truck include color warnings on footboards, on moving parts of cable reels and around gas tank filler pipe. Shop foreman Marvin T. Pettyjohn directs Merle E. Lamb in painting the approved code colors on a truck being built in Stanolind's Tulsa shops

A WELL-PLANNED year-round safety program is paying handsome dividends to Stanolind Oil & Gas Company as well as saving the lives and health and earning power of its employes. So successful has this program proved that Stanolind employe groups have won seven of the 26 safety awards given this year in the petroleum industry by the Joseph A. Holmes Safety Association, considered to be the highest safety awards in the oil industry.

According to the company's safety record, working in an oil field for Stanolind is safer than working in textile mills, food plants, stores, or in many other seemingly "safer" places.

In spite of potential hazards around tall derricks, heavy equipment, fast-moving machinery, and oil and gas under high pressure, the company's accident prevention program is so successful that Stanolind employes have only half as many lost-time accidents as do the average American industrial workers.

Safety experts measure accident records in terms of the number of lost-time accidents for each million man-hours worked. It takes 500 men working a year to total a million man-hours. Any accident that causes a man to miss part of his next day's work is counted as a lost-time accident.

In 1947 Stanolind had only about five lost-time accidents for each million man-hours worked, compared with the petroleum industry average of 14 and the same average for industry in general over the nation.

Don A. Klemme, Stanolind safety supervisor, says two things are required for a successful safety program. "First, company management from the president on down must believe that safety is part of every job; second, every supervisor has to be constantly teaching his men how to work safely."

In addition to the humanitarian aspects of saving lives and preventing crippling injuries, companies have found that a good safety program represents substantial "dividends" through savings in hospital and medical bills, compensation claims, working time lost, and property damage.

Stanolind conducts a weekly half-hour employe safety meeting on company time. Field supervisors and foremen plan and conduct these meetings. Drivers of company cars and trucks get special safety training. New field men are given a first-aid course on company time and, as a result, most of the older employes are cognizant of first-aid principles and apply them always.

Safety records show that twice as many industrial workers are killed at home or on the highway as on the job. Good safety training at work is also paying off away from the job for Stanolind men.

Principal emphasis in Stanolind's safety training is on planning to do a job safely before the job is started. Supervisors and men plan together the safe way of doing each job. Safety helmets, safety shoes, guards for moving equipment, handrails, and safety belts for high work are used whenever planning shows they are needed.

Stanolind also specializes in visual safety training through the showing of safety films.

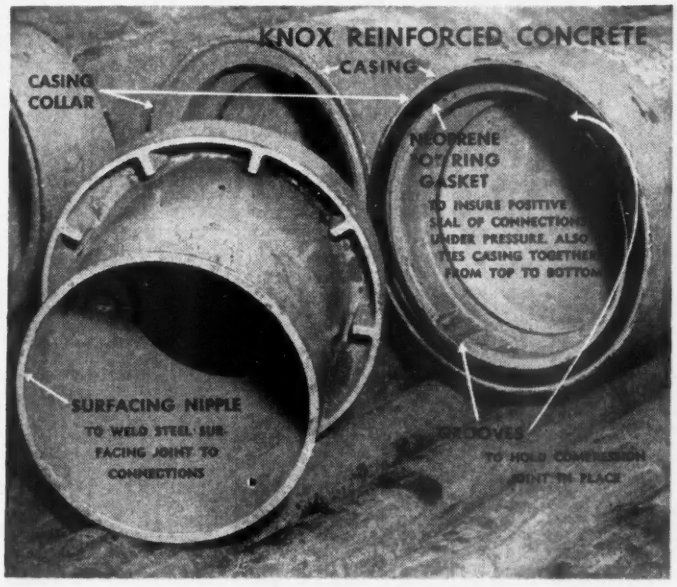
Last year Stanolind employe groups won ten of the 34 Holmes safety awards given. The Joseph A. Holmes Safety Association is composed of 26 leading national organizations in the mining, metallurgical, petroleum and allied industries, along with the National Safety Council, American Red Cross, and American Petroleum Institute.

NEWS!

PERMANENT NON-CORROSIVE CASING

Knox reinforced concrete surface casing is NEW! – And it's NEWS! Casing made of cement reinforced by welded steel rod means a tremendous saving in steel, freeing the operator of worries caused by material shortages. Knox reinforced concrete casing is unaffected by corrosion or electrolysis. It combines strength with flexibility. Connections are sealed with special joints on neoprene rings. The casing is designed for maximum setting depths of 2,500 feet. Rated compression strength 5,500 pounds. Knox reinforced concrete casing is equal to comparable steel casing AND is becoming *increasingly* available. Call, write or wire or further information.

Chas. E. Knox


KNOX REINFORCED CONCRETE CASING
CASING COLLAR
NEOPRENE O-RING GASKET
TO INSURE POSITIVE SEAL OF CONNECTIONS UNDER PRESSURE. ALSO TIES CASING TOGETHER FROM TOP TO BOTTOM
SURFACING NIPPLE
TO WELD STEEL SURFACING JOINT TO CONNECTIONS
GROOVES
TO HOLD COMPRESSION JOINT IN PLACE

KNOX REINFORCED CONCRETE CASING

ADVANTAGES TO THE OPERATOR

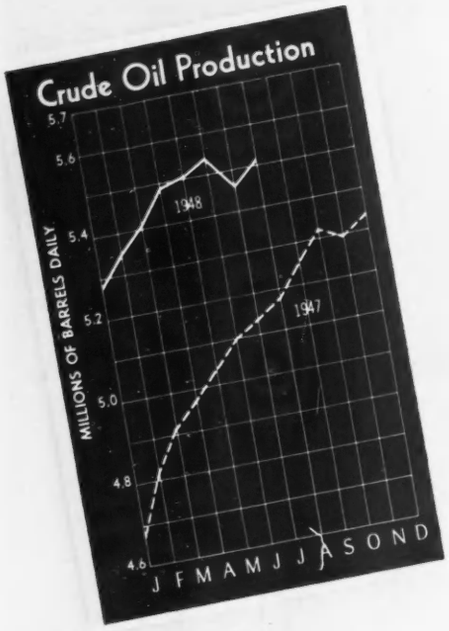
1. Non-corrosive, unaffected by electrolysis, liquids or gases.
2. Unaffected by steel supplies.
3. Amply strong. Reinforced by ⅜" mesh welded to special alloy collars at casing ends.

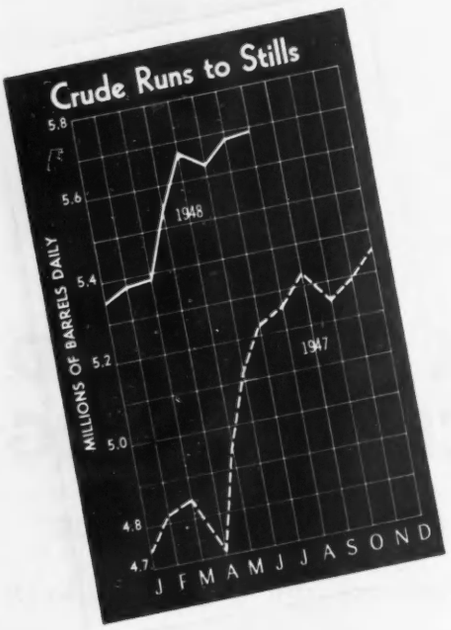
MANUFACTURED BY

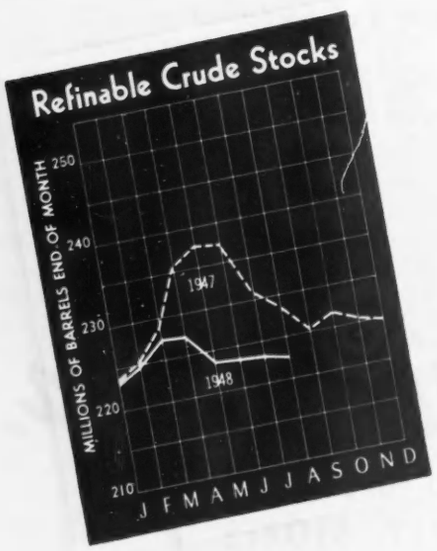
Knox Industries Corp.

KNOX BLDG. ENID, OKLA.

DISTRIBUTED BY INDEPENDENT SUPPLY STORES







Refined Products Stocks

U. S. refineries did not process as much crude oil during August as in the previous month, but their activity was still high by any standard. On the other hand the industry's producers hiked crude oil output. However, production had been down slightly during July and even with August's increase it was still behind the all-time high reached during June of this year.

Stocks of the principal refined products were in fairly good position at the end of the month. Gasoline was still in heavy demand at the time and inventories of this commodity were holding up remarkably well. However, the long Labor Day holiday which was yet to come was expected to make heavy inroads into these stocks, but with the heavy gasoline season almost over, inventories were unusually high and fairly well distributed. This gasoline position is making it possible to switch refinery yields in order to favor the fuel oils that have yet to make their debuts as the heavy demand products. These fuel stocks are now at high levels, and with some time left to continue to build, the heating season will most likely get underway with the industry's tanks well filled.

Since the end of August there has come some darkening of this otherwise bright supply picture. Much of California's producing and refining capacity has been shut down by strikes of industry workers. Refining

Crude Oil and Refined Products Trends
(THOUSANDS OF BARRELS)

	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL	
MONTH	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month
1945:									
January	4,756	4,680	221,737	2,094	91,666	663	31,695	1,350	44,347
February	4,767	4,817	220,221	2,194	97,457	724	27,210	1,326	39,760
March	4,804	4,719	223,988	2,124	97,447	675	26,729	1,273	35,451
April	4,807	4,774	224,229	2,127	90,804	681	29,148	1,289	34,418
May	4,887	4,913	223,151	2,179	88,530	708	29,511	1,341	34,333
June	4,859	4,989	218,218	2,166	86,128	730	32,440	1,351	35,606
July	4,897	5,001	216,638	2,281	85,582	713	36,276	1,351	38,341
August	4,870	4,928	215,135	2,269	84,003	701	41,245	1,329	42,227
September	4,423	4,275	220,319	1,933	74,574	640	45,059	1,139	42,822
October	4,284	4,244	221,246	1,888	76,805	613	45,479	1,176	42,008
November	4,517	4,624	218,916	2,156	86,540	665	44,562	1,265	41,322
December	4,472	4,574	218,763	2,056	97,676	683	35,778	1,245	37,158
1946:									
January	4,625	4,520	223,442	1,914	102,394	787	28,990	1,224	34,573
February	4,719	4,651	227,220	1,884	104,836	823	25,511	1,243	34,008
March	4,414	4,661	221,400	1,900	104,161	815	29,922	1,213	32,995
April	4,673	4,663	222,480	1,943	98,744	773	32,064	1,247	35,206
May	4,785	4,794	221,592	2,016	93,960	753	33,385	1,220	38,932
June	4,896	4,836	223,140	2,055	91,971	777	38,824	1,219	41,492
July	4,922	4,856	224,351	2,102	87,778	793	46,439	1,163	45,446
August	4,836	4,856	224,157	2,189	86,745	765	54,068	1,159	48,186
September	4,790	4,839	222,417	2,143	87,021	796	62,019	1,150	54,012
October	4,785	4,736	222,177	2,117	85,952	788	76,780	1,090	55,580
November	4,823	4,684	226,453	2,162	88,587	791	68,145	1,101	52,735
December	4,725	4,789	224,473	2,168	92,742	805	59,912	1,159	47,094
1947:									
January	4,671	4,739	223,848	2,078	99,623	778	48,197	1,174	41,550
February	4,810	4,820	225,121	2,089	103,672	777	36,901	1,228	48,480
March	4,908	4,843	228,981	2,076	105,679	825	31,423	1,222	37,403
April	4,974	4,707	235,710	2,037	101,724	764	30,268	1,148	36,455
May	5,033	4,947	237,768	2,128	95,209	805	34,279	1,204	39,992
June	5,099	5,120	237,278	2,258	89,774	807	39,676	1,233	43,515
July	5,137	5,221	230,974	2,302	86,003	847	46,444	1,244	47,600
August	5,173	5,260	228,523	2,383	85,849	869	54,707	1,245	51,334
September	5,251	5,236	225,258	2,375	84,360	911	59,764	1,237	52,578
October	5,320	5,253	226,666	2,371	82,584	938	63,252	1,260	52,502
November	5,291	5,291	225,462	2,332	87,551	942	61,334	1,245	52 455
December	5,337	5,350	224,929	2,347	92,303	992	51,081	1,282	47,091
1948:									
January	5,283	5,348	223,430	2,328	102,167	1,082	41,036	1,278	44,636
February	5,353	5,380	224,880	2,264	110,999	1,127	34,590	1,295	43,156
March	5,406	5,387	227,408	2,252	111,949	1,050	32,214	1,307	41,945
April	5,484	5,540	227,278	2,396	109,829	978	34,514	1,303	43,301
May	5,502	5,668	223,820	2,486	108,552	992	40,781	1,314	48,518
June	5,544	5,632	223,481	2,529	104,518	998	48,352	1,280	52,465
July	5,460	5,685	223,137	2,549	99,116	1,011	56,661	1,288	58,130
August	5,517	5,589	222,401	2,522	95,242	1,047	67,515	1,260	63,747
August, 1948 Change:									
In Month	+57	−96	−736	−27	−3,874	+36	+10,854	−28	+5,617
In One Year	+344	+329	−6,122	+139	+9,393	+178	+12,808	+15	+12,413
In Two Years	+681	+733	−1,756	+333	+8,497	+282	+13,447	+101	+15,561

Trends

In Fairly Good Condition

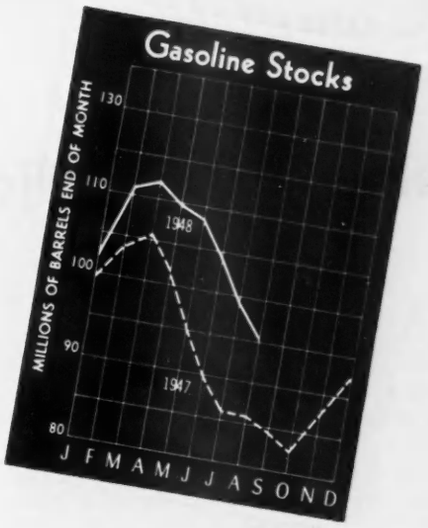
has been cut to less than half of normal and crude oil production has been lowered by about 30 percent. Enough gasoline is not available on the West Coast and use must be lessened. The dispute doesn't seem headed for an early settlement and the motor fuel situation will become more critical as stocks are further dissipated.

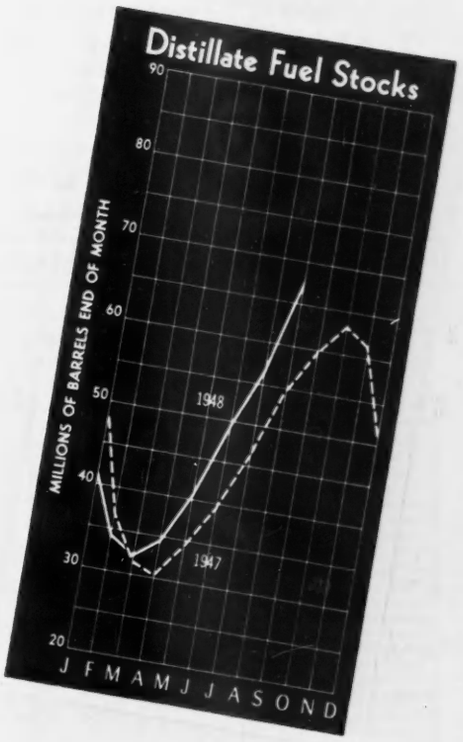
Daily refinery runs in the U. S. averaged 5,589,000 barrels during August to show a drop of 96,000 barrels daily from July's all-time record of 5,685,000 barrels. About 95 percent of the nation's total refining capacity was required to handle August's daily runs to stills.

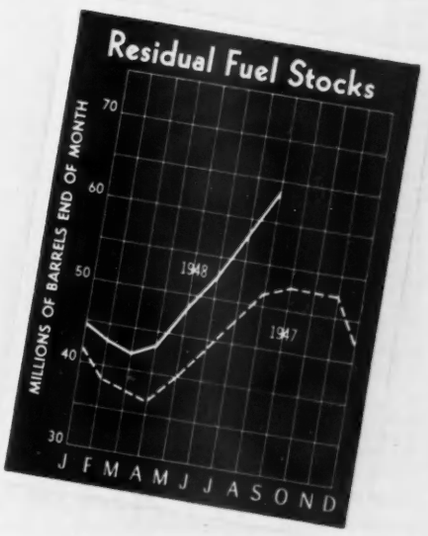
Output from the nation's oil fields averaged 5,517,000 barrels a day during the month. That was an increase of 57,000 barrels daily over July's daily production, but July had dropped 84,000 barrels from its preceding month and so this latest increase still didn't bring output up to the June level.

Stocks of gasoline were lowered 3,874,000 barrels during August to end the period totalling 95,242,000 barrels. That amount was 9,393,000 barrels or almost 11 percent greater than stocks on hand a year before. Production of gasoline, including natural blended at refineries, amounted to 2,522,000 barrels daily in the month, which was a slight drop of 27,000 barrels a day from July's gasoline output.

Distillate fuel oil stocks climbed 10,854,000 barrels during the month to total 67,515,000 barrels. Stocks of these light heating oils now amount to 12,808,000 barrels, 23 percent more than stocks a year ago. Even though total refining operations were cut back, production of these light fuels was hiked. An increase of 36,000 barrels a day boosted August's production to 1,047,000 barrels daily. This was accomplished by advancing the refinery yield of this product at the expense of gasoline and the heavier residual fuel oils.







State Crude Oil Production
(THOUSANDS OF BARRELS)

STATE OR DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL FIRST EIGHT MONTHS		
	August, 1948	July, 1948	August, 1947	% Diff. August, '47-'48	1948	1947	% Diff. '47-'48
Alabama	1.4	1.3	1.0	+ 40.0	314	248	+ 26.6
Arkansas	82.3	81.8	81.1	+ 1.5	20,679	19,610	+ 5.5
California	950.4	948.7	917.7	+ 3.6	230,047	220,465	+ 4.3
Colorado	47.6	47.9	48.3	— 1.4	11,261	9,992	+ 12.7
Florida	0.8	0.9	1.0	— 20.0	195	161	+ 21.1
Illinois	179.7	171.9	174.9	+ 2.7	42,508	44,653	— 4.8
Indiana	21.4	20.7	16.2	+ 32.1	4,196	4,108	+ 2.1
Kansas	300.3	297.6	295.3	+ 1.7	72,528	69,246	+ 4.7
Kentucky	25.2	24.0	25.1	+ 0.4	5,792	6,164	— 6.0
Louisiana	482.6	475.8	443.3	+ 8.9	117,628	104,234	+ 12.8
North Louisiana	113.3	113.1	98.5	+ 15.0	28,202	23,723	+ 18.9
South Louisiana	369.3	362.7	344.8	+ 7.1	89,426	80,511	+ 11.1
Michigan	46.3	43.5	44.5	+ 4.0	10,967	10,521	+ 4.2
Mississippi	127.0	121.6	99.1	+ 28.2	29,694	22,050	+ 34.7
Missouri	0.1	0.1	0.1	.....	36	36	.....
Montana	25.7	25.3	24.8	+ 3.6	6,123	5,682	+ 7.8
Nebraska	0.4	0.4	0.5	— 20.0	142	147	— 3.4
New Mexico	133.1	128.2	118.1	+ 12.7	31,450	26,235	+ 19.9
New York	13.9	14.2	12.7	+ 9.4	3,178	3,164	+ 0.4
Ohio	9.8	10.2	8.4	+ 16.7	2,211	2,008	+ 10.1
Oklahoma	427.3	426.9	384.0	+ 11.3	100,941	91,903	+ 9.8
Pennsylvania	32.7	33.9	34.1	— 4.1	8,411	8,420	— 0.1
Tennessee	.....	.....	0.1	—100.0	5	6	+ 16.7
Texas	2,447.9	2,455.3	2,315.4	+ 5.7	592,733	530,562	+ 11.7
Dist. 1—South Central	29.0	28.6	23.5	+ 23.4	6,587	5,130	+ 28.4
Dist. 2—Middle Gulf	179.0	173.7	159.3	+ 12.4	42,240	37,502	+ 12.6
Dist. 3—Upper Gulf	493.5	497.6	487.1	+ 1.3	120,609	114,849	+ 5.0
Dist. 4—Lower Gulf-S.W.	250.4	256.4	241.4	+ 3.7	61,858	56,996	+ 8.5
Dist. 5—East Central	49.1	47.0	39.5	+ 24.3	11,248	9,221	+ 22.0
Dist. 6—Northeast	424.8	433.9	439.5	— 3.3	105,025	105,745	— 0.7
Dist. 7-B—N. Central	50.9	48.3	39.3	+ 29.5	11,266	9,044	+ 24.6
Dist. 7-C—West Central	43.7	46.0	39.5	+ 10.6	10,767	8,677	+ 24.1
Dist. 8—West	703.4	697.6	619.4	+ 13.6	166,197	127,394	+ 30.5
Dist. 9—North	138.0	139.9	126.9	+ 8.7	33,959	31,653	+ 7.3
Dist. 10—Panhandle	86.1	86.3	83.6	+ 3.0	21,100	20,542	+ 2.7
Virginia	0.1	0.2	0.1	.....	29	51	— 43.1
West Virginia	7.4	7.4	7.0	+ 5.7	1,777	1,689	+ 5.2
Wyoming	153.7	145.4	120.3	+ 27.8	35,451	28,130	+ 26.0
Total United States	5,517.1	5,459.7	5,173.1	+ 6.6	1,328,296	1,209,485	+ 9.8

Completions

Reach New High of 3820

A NEW all-time high for wells completed was set in August when 3820 tests were finaled to far outreach any comparable period. Drilling increased steadily since the end of the first quarter of this year and with the number of drilling rigs that are now active and the great number of announced drilling locations, it appears that this high activity will continue for most of the remainder of the year. If the industry can hold the pace (which is to say if tubular supplies will permit continuance of the pace), it appears that forecasts of slightly over 38,000 wells for 1948 will be shy about 1000.

Well completions in August totaling 3820 showed a considerable increase over July's 3549 wells and an even greater gain over the 3083 completed in August of last year. A new monthly record was also set in footage drilled. August's new well footage totaled 13,196,472 feet for an average of 3488 feet per well. July's footage amounted to just under 12 million for a well average of 3397 feet. In August a year ago wells were 3289 feet deep on the average.

At the end of eight months, 25,381 wells had been completed in 1948 for an increase of 19 percent over last year's 21,334. Of these totals 23,661 and 19,500, respectively, were new wells drilled for oil or gas, the remaining were either service wells, salt water disposal and pressure input, or old wells drilled deeper. Of these tests aimed at production, last year's successful producers numbered 13,546 or 69.5 percent, while this year's producing wells totaled 16,160 for a slightly lower score of 68.3 percent of the total.

Almost all states of drilling consequence have shared in the over-all increase in drilling this year over last. California's record shows a 42 percent increase, Kansas 22 percent, Louisiana 47, Oklahoma 12, and Wyoming 134 percent. Illinois and Indiana were up 17 and 83 percent, respectively. Texas, largest drilling state of all, showed a rise of 26 percent over last year.

Well Completions in the United States During August, 1948, and Cumulative for Year

(Figures compiled by WORLD OIL staff from private reports and other sources as follows: Illinois from Illinois Geological Survey; Indiana from Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon, and Allegany fields of Pennsylvania and New York from The Producers' Monthly.)

STATE OR DISTRICT	MONTHLY COMPLETIONS, AUGUST, 1948 — NEW WELLS: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	TOTAL COMPLETIONS: Aug., 1948	July, 1948	Aug., 1947	Footage August, 1948	CUMULATIVE TOTAL January-August: Wells 1948	Wells 1947	Percent Diff.	Footage 1948	Rigs in Operation (Drilling, Rigging Up and Shut Down): Aug. 31, 1948	July 31, 1948	Aug. 31, 1947
Alabama				2				2		2	3	2	7,145	13	14	— 7.1	66,561	2	2	6
Arizona														1			630	6	6	
Arkansas	12			19				31		31	38	42	113,268	208	188	+ 10.6	828,525	40	45	42
California	198		3	54				255	6	261	216	153	923,311	1,752	1,230	+ 42.2	6,134,046	305	272	277
Colorado	12			5				17		17	18	18	94,796	159	122	+ 30.3	852,921	51	46	81
Florida				3				3		3	4	3	14,344	19	22	— 13.6	111,587	6	5	6
Georgia				1				1		1			4,910	3	3		13,781			1
Illinois	102		2	113				217		217	279	208	570,833	1,526	1,298	+ 17.6	4,003,953	260	237	217
Indiana	50			52				102		102	101	54	203,452	671	367	+ 82.8	1,266,111	137	105	82
Kansas	153		35	122			4	314		314	261	225	1,041,537	1,984	1,620	+ 22.2	6,526,077	253	257	387
Kentucky	24		23	30				77		77	81	82	152,222	516	570	— 9.5	1,023,000	78	88	116
Louisiana	139	12	10	57	1		2	221		221	196	173	1,024,306	1,441	980	+ 47.0	7,195,364	219	214	188
North Louisiana	100	4	9	31	1		2	147		147	131	107	358,337	922	561	+ 64.3	2,520,086	74	73	71
South Louisiana	39	8	1	26				74		74	65	66	665,969	519	419	+ 23.9	4,675,278	145	141	117
Maryland														1			5,259			
Michigan	34		1	37				72		72	86	81	168,114	469	425	+ 10.4	1,078,633	127	118	121
Mississippi	20	2	1	23				46		46	38	39	339,893	277	303	— 8.6	2,223,962	49	48	78
Missouri	2		1	3				6	1	7	5		2,486	38	28	+ 35.7	12,451	7	8	6
Montana	17		1	10				28	1	29	28	23	63,648	198	130	+ 52.3	484,848	53	51	78
Nebraska														1	1		4,965	2	2	5
Nevada																		1	1	
New Mexico	36		1	12				49		49	43	42	204,029	416	389	+ 6.9	1,687,681	107	102	134
New York	110				71			181		181	164	198	251,541	1,197	1,181	+ 1.4	1,730,295	214	201	240
North Carolina															1	—100.0				
Ohio	44		39	46				129		129	106	124	303,790	860	881	— 2.4	2,151,842	215	213	252
Oklahoma	224		40	147				411	11	422	389	296	1,620,727	2,729	2,439	+ 11.9	9,701,091	558	556	527
Oregon															1	—100.0				
Pennsylvania	120		44	21	109	18		312	1	313	273	351	549,915	2,180	2,242	— 2.8	3,777,265	433	421	431
South Dakota														1			1,365	1		
Tennessee											4	2		32	13	+146.2	43,647	18	18	11
Texas	718	16	41	376	1	2		1,154	11	1,165	1,083	847	5,007,987	7,803	6,171	+ 26.4	33,189,545	1,382	1,451	1,393
Dist. 1—South Central	17	1		16				34		34	46	34	128,966	312	213	+ 46.5	995,432	33	40	36
Dist. 2—Middle Gulf	32	3	4	22				61		61	61	58	366,703	506	421	+ 20.2	2,935,740	64	63	62
Dist. 3—Upper Gulf	53	7	8	40				108	1	109	96	79	670,186	711	548	+ 29.7	4,589,310	124	140	137
Dist. 4—L. Gulf-S.W.	79	3	4	46		1		133	1	134	109	79	627,241	916	735	+ 24.6	4,428,025	108	130	109
Dist. 5—E. Central	13		1	14				28		28	17	15	125,917	145	96	+ 51.0	693,648	30	33	22
Dist. 6—Northeast	15	1	7	12				35	1	36	35	46	170,646	254	327	— 22.3	1,363,338	35	45	68
Dist. 7-B—N. Central	85		3	75				163	2	165	123	90	517,255	923	574	+ 60.8	2,870,234	190	188	126
Dist. 7-C—W. Central	22	1		16				39	3	42	42	25	225,194	269	172	+ 56.4	1,123,737	71	73	73
Dist. 8—West	259		1	26				286	2	288	268	170	1,390,581	1,926	1,292	+ 49.0	8,895,307	459	472	495
Dist. 9—North	107			106	1	1		215	1	216	241	209	620,929	1,485	1,470	+ 1.0	4,140,239	118	110	136
Dist. 10—Panhandle	36		13	3				52		52	45	44	164,369	356	323	+ 10.2	1,154,535	150	157	129
Utah			1	1				2		2	1		6,232	5	3	+400.0	60,594	12	12	6
Virginia														1			2,301			
Washington														2			11,205			
West Virginia	15		50	11				76	1	77	81	96	206,949	529	567	— 6.7	1,350,867	390	388	382
Wyoming	54		1	22				77	5	82	48	24	352,937	339	145	+133.8	1,381,934	142	146	116
Total United States	2,084	30	294	1,167	182	20	6	3,783	37	3,820	3,549	3,083	13,228,372	25,381	21,334	+ 19.0	86,922,315	5,058	5,013	5,163

Exploration

Results in Three New Fields

By CECIL SMITH
Staff Writer

THE venturesome oil industry that wasn't content with ordinary drilling on solid ground or in shallow calm waters and that went out to the open waters of the Gulf of Mexico in its search for new oil sources enjoyed its most successful period during August. During the month this hazardous and expensive activity resulted in the opening of three new oil and gas fields and the addition of a new oil sand to the first field discovered in these open waters.

Although not included in August's record, another tidelands discovery has been since completed and several other tests are nearing critical depths. While these marine discoveries are important and certainly spectacular, two other recent oil strikes are perhaps more significant, at least to their respective areas, for they occurred in states that have had little oil success. One of these wells added Utah to the list of producing states and the other indicates a new discovery for Florida, that has had some production from a lone field.

Highlighting the Gulf of Mexico oil play was the completion of Humble Oil & Refining Company's State Lease 801-1, with an initial flowing production of 840 barrels of 30.9-gravity oil. Production was made through a ¼-inch choke and came from the interval 8640-65 feet.

Summary of Results of Exploratory Drilling

ITEM	Aug., 1948	July, 1948	EIGHT MONTHS: Jan.-Aug. 1948	1947	Percent Diff.
Oil Discoveries	88	87	580	445	+ 30.3
New Fields	78	65	389	253	+ 53.8
New Pays	10	22	191	192	— 0.5
Distillate Discoveries	8	11	64	68	— 5.9
New Fields	6	5	35	32	+ 9.4
New Pays	2	6	29	36	— 19.4
Gas Discoveries	16	14	90	71	+ 26.8
New Fields	13	11	66	52	+ 26.9
New Pays	3	3	24	19	+ 26.3
Total Discoveries	112	112	734	584	+ 25.7
Extensions to Fields	11	29	133	101	+ 31.7
Oil Fields	9	28	111	76	+ 46.1
Distillate Fields	.....	.....	8	9	— 11.1
Gas Fields	2	1	14	16	— 12.5
Total Prod. Tests	123	141	867	685	+ 26.6
Dry Holes	526	536	3,498	2,714	+ 28.9
Wildcats	521	533	3,450	2,626	+ 31.4
New Pays	.....	.....	7	48	— 85.4
Outposts	5	3	41	40	+ 2.5
Total Expl'tory Tests	649	677	4,365	3,399	+ 28.4
Percent Productive	19.0	20.8	19.9	20.2	.....
Percent Dry	81.0	79.2	80.1	79.8	.....

Results of Exploratory Drilling in August and First 8 Months, 1948-1947, By Districts

State or District	MONTH OF AUGUST, 1948													FIRST EIGHT MONTHS, 1948																
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests								Unproductive Tests					Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions			Total Productive				Total Dry			
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	8 Mo. 1948	8 Mo. 1947	Wildcats	New Pays	Outposts	8 Mo. 1948	8 Mo. 1947	8 Mo. 1948	8 Mo. 1947
Alabama											2			2												13			13	10	13	10
Arizona																										1			1		1	
Arkansas											13			13	4									4	6	69			69	42	73	48
California	2						2			4	12			16	12		1	6			16	1	1	37	19	152			152	172	189	191
Colorado	1									1	5			6	1		1							2	5	35			35	28	37	33
Florida											3			3												16			16	21	16	21
Georgia											1			1												3			3	3	3	3
Illinois	2			2		1	3			8	43			51	18			20		1	28			67	93	316			316	256	383	349
Indiana	4						1			5	22			27	21		1	3			6			31	14	158			158	78	189	92
Iowa																															
Kansas	6		1							7	53			60	45		3	2			1			51	46	310	1		311	220	362	266
Kentucky											6			6	4		1	1			1			7	4	35			35	37	42	41
Louisiana	6	1	1	2	1					11	21			32	12	11	5	33	11	2	4	3	1	82	57	152		1	153	180	235	237
North Louisiana		1								1	11			12	5	1	2	1			3	2	1	15	12	77			77	120	92	132
South Louisiana	6		1	2	1					10	10			20	7	10	3	32	11	2	1	1		67	45	75		1	76	60	143	105
Maryland																										1			1		1	
Michigan			1				1			2	27			29	8		4				2			14	11	161			161	135	175	146
Mississippi	1									1	19			20	1	1					2			4	5	66		1	67	55	71	60
Missouri											4			4												11			11	9	11	9
Montana											4			4	2			1			1			4	3	21			21	8	25	11
Nebraska																														1	1
New Mexico				1						1	6			7	6	1	1	5		1				14	6	44			44	43	58	49
New York																															
North Carolina																														1	1
Ohio											4			4	1		1				1		7	10	6	25			25	32	35	38
Oklahoma	8		3	1						12	43		1	56	40	2	14	18			4			78	67	318		2	320	357	398	424
Oregon																														1	1
Pennsylvania																										3			3	3	3	3
South Dakota																										1			1		1	
Tennessee															1									1		21			21	12	22	12
Texas	47	5	4	4	1	2	2		2	67	216		4	287	203	20	25	91	18	20	41	4	5	427	330	1456	6	35	1497	974	1924	1304
Dist. 1 S. Central	2									2	13			15	3			1		1				5	9	122			122	81	127	90
Dist. 2 Middle Gulf	1	1	1	1					1	5	12			17	11	2	4	14	7	4	3	2	1	48	48	122	1	6	129	79	177	127
Dist. 3 Upper Gulf	2	2	1	1	1	1	1			9	20			29	12	6	4	31	5	5	4	1	2	70	57	168	1	3	172	111	242	168
Dist. 4 L. Gulf-S.W.	4	2			1				1	8	30		2	40	17	10	4	14	6	10	2	1	1	65	80	214	1	16	231	159	296	239
Dist. 5 E. Central											13			13	4			2			1			7	5	55			55	43	62	48
Dist. 6 Northeast	1									1	5			6	3	2		4			5			14	8	42	2		44	37	58	45
Dist. 7-B N. Cent.	15		1	1						17	45		1	63	58		9	12			4			83	43	268		1	269	160	352	203
Dist. 7-C W. Cent.	3									3	9		1	13	12			2			2			16	12	66		1	67	25	83	37
Dist. 8 West	9		1	1			1			12	14			26	44		3	4			12		1	64	25	112	1	4	117	86	181	111
Dist. 9 North	10									10	54			64	39		1	7			8			55	41	284		4	288	178	343	219
Dist. 10 Panhandle											1			1											2	3			3	15	3	17
Utah			1							1	1			2			3							3		12			12	3	15	3
Virginia																	1							1							1	
Washington																										2			2		2	
West Virginia			1							1	2			3			3							3	3	2			2	6	5	9
Wyoming	1		1							2	14			16	10		2	11			4			27	10	46		2	48	27	75	37
Total U.S.	78	6	13	10	2	3	9		2	123	521		5	649	389	35	66	191	29	24	111	8	14	867	685	3450	7	41	3498	2714	4365	3399

This test located 8½ miles off the Louisiana coast in the Gulf was drilled from the company's widely publicized million-dollar drilling platform and marked Humble's first successful tidelands venture.

The second oil discovery in the open sea for the month was The California Company's State Lease 1278-1, located six miles east of Louisiana's Delta Duck field and in the North Pass area of Plaquemines Parish. This test flowed 216 barrels of 26.2-gravity oil through 5/32-inch choke from the section 5858-67 feet. The hole was drilled to a total depth of 9254 feet and numerous other sands that may produce oil were logged.

The new gas field was opened by Magnolia Petroleum Company's Ship Shoal 766-1, eight miles south of the Coon Point field in Terrebonne Parish, southern Louisiana. From 7266 to 7276 feet the well gauged 118 million cubic feet of gas on open flow and is now shut in. Prior to completion of the discovery, tests were conducted up the hole and at the 6800-foot level some 42-gravity oil flowed.

Not officially completed in August, a third pay zone has since been added to the Block 32 field, an oil field discovered late in 1947 to become the first in the open waters of the Gulf. This new well was the third to be drilled from the original platform and each of the producers are flowing from different formations. These wells are owned by Kerr-McGee Oil Industries, Inc. and the latest, State Block 32, Lease 754-3, was finished flowing 750 barrels of 25.6-gravity oil through ½-inch choke with production coming through perforations at 1758-74 feet.

Of prime importance to Utah was the bringing in of the state's first commercial producing oil well. At this writing the Equity Oil Company is preparing for completion at its N. J. Meagher No. 1, successful wildcat on the Ashely Valley structure in Uintah County, after gauging a flow of six barrels of 32-gravity black oil per hour from the Weber sand on the initial 19-hour test. This first for Utah is located about eight miles southeast of the town of Vernal.

The flow started from 18 feet in the Weber sand which was topped at 4134 feet. This formation is the same that has proved so prolific in the revived Rangely, Colo., field, 35 miles to the east. Plans call for completion without deepening and present estimate for the well, after cleaning, is 300 barrels per day. The oil is now going into temporary storage on the lease and will probably be trucked to a small refinery at Jensen, Utah, three miles away.

There is promise of a new and second oil field for Florida ten miles southwest of the Sunniland field in the southern part of the state. Humble Oil & Refining Company's Gulf Coast Realty Company No. 1-C, Section 21-47s-28e, recovered 660 feet of 20.4-gravity oil with about 20 percent oil-cut mud on a drill-stem test at interval 11,918-38 feet. Drilling was continued to 12,120 feet and electrical survey was being run at latest report.

The Sunniland field, Florida's lone producing area, was discovered by Humble in 1943. At that time Humble collected a reward offered by the state for the first commercial production. Since that discovery no new finds have resulted from the drilling of nearly 100 wildcats by various operators.

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in August, 1948

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		CALIFORNIA—New Oil Fields						
Kern	.....	Ring Oil Co's Well 20-1, 1510 s 600 e fr nwc Sect 20-27s-28e, Mount Poso area	8-11-48	2337	2307- 2337	Vedder sd; Mio	P 41; 4 wtr	16
San Benito	.....	Texas Co's Nicholas 1, 527 n 994 e fr swc Sect 28-16s-12e, Ciervo area	8- 1-48	1252	1103- 1185	.....	P 19	24.8
		CALIFORNIA—Oil Field Extensions						
Kern	Paloma	Western Gulf Oil Co's KCL-NW 14-28, Sect 28-31s-26e, n ext	8-20-48	11379	-11379	Stevens sd; Mio	F 223; 12 wtr; 11/32"	31.9
Los Angeles	Potrero	Basin Oil Co's Inglewood Comm. 7-1, Sect. 28-2s-14w	8-27-48	11123	10104-10134	Miocene	F 30; 15 wtr; 11/64"	46
		COLORADO—New Gas Field						
Montezuma	.....	Byrd-Frost & Western Nat'l MacIntosh 1, (OWWO) c nw nw 25-30n-18w, Mcelmo Dome.	8-10-48	4965	1528- 1535	Shinarump cgl; Tri	0.3 mln	....
		ILLINOIS—New Oil Fields						
Wabash	Maud, W.	O. D. Sharp's G. Wells 1, se sw se 29-1s-13w, 2 mi w Maud pl.	8-17-48	2570	2428- 2435	Cypress sd; Miss	P 17; 3 wtr	....
Wabash	Maud, Cent.	C. E. Skiles' H. Groff 1, sw se sw 21-1s-13w, 1 mi ne Maud, W. pl.	8-10-48	2622	2607- 2621	Bethel sd; Miss	P 104	....
		ILLINOIS—New Oil Pays						
Clay	Clay City, N.	Calvert & Willis & Ashland's Bemis "B" 6, se ne 8-3n-8e	8-31-48	2658	2649- 2658	Cypress sd; Miss	P 90; 35 wtr	....
Richland	Passport	Arvin Drlg Co's Stone 1, ne se se 18-4n-9e	8-17-48	3033	3027- 3033	Rosiclare li; Miss	P 54	....
		ILLINOIS—Oil Field Extensions						
Jefferson	Divide, E.	Shulman Bros.' Halloway 1, nw nw ne 21-1s-4e. ¾ mi e ext.	8-17-48	2797	2759- 2797	McClosky li; Miss	P 100; 20 wtr	....
Jefferson	King	A. J. Slagter's Modert et al 1, nw sw se 22-3s-3e. ¾ mi ne extension	8-24-48	2870	2764- 2772	Aux Vases sd; Miss	P 35; 15 wtr	....
Wayne	Barnhill	Central Pipe Line Co et al's A. J. Bose 1, se se se 28-2s-8e. ½mi w ext.	8-10-48	3463	3455- 3461	McClosky li; Miss	P 99; 12 wtr	....
		ILLINOIS—New Gas Pay						
Coles	Mattoon	W. Duncan's G. Taylor 7, nw ne nw 11-12n-7e	8-24-48	3228	3122- 3140	Dutch Creek sd; Devo	3 mln	....
		INDIANA—New Oil Fields						
Gibson	McGary	Geo. S. Engle's John Teel 1, se sw nw 16-3s-11w. 1½ mi fr prod.	8-20-48	1703	1684- 1703	Waltersburg sd;. Miss	P 150	....
Sullivan	Wilfred	F. B. Cline's H. A. Seipman 1, sw ne sw 30-9n-8w, 2½ mi fr prod.	8-20-48	3039	3032- 3039	Devonian li	F 75; 150 wtr 1/2"	....
Vanderburgh	Darmstadt	Gilliam Drlg. Co's Spilker 1, se sw nw 12-5s-11w, 4 mi nw Vanderburgh pl.	8-20-48	2591	2456- 2462	McClosky li; L Miss	P 270	....
Vanderburgh	.....	H. L. Cokes—N. Davies-Aurora Gasoline Co's H. Boeke, se ne ne 6-6s-11w, 2 mi fr prod.	8-10-48	2655	2562- 2569	Aux Vases li; U Miss	P 58	....
		INDIANA—Oil Field Extensions						
Gibson	Mt. Carmel, Consol	Illinois Mid-Continent's McFarland-Andrews 1, nw sw nw 19-1s-11w, ½ mi e extension.	8-31-48	2438	2346 -2359	Rosiclare li; Miss	F 100; ½"	....
		KANSAS—New Oil Fields						
Kiowa	.....	Drillers Gas Co's Lorimor 1, c se nw 20-30s-20w, 9 mi w Alford pl.	8-31-48	5278	5126- 5154	Mississippi li; Miss	P & F 176; 28 wtr	33
Rooks	Boxelder	Nat'l Co-op Ref Assn's Smith 1, se se sw 8-9s-18w, 1 mi e of Barry, SE pl.	8-31-48	3496	3491- 3496	Arbuckle li; Ord	Sw 840	....
Russell	Meier	El Dorado Ref. Co's Meier 1, se se nw 30-15s-12w, 1 mi n Ney pl.	8-10-48	3331	3325- 3331	Arbuckle li; Ord	P 252	....
Sedgwick	.....	J. P. Gaty's Broers 1, cnl se sw 5-26s-2e, 1 mi n Fairview pl.	8-31-48	2974	2973- 2974	Burgess sd; Penn	P 776	....
Sedgwick	.....	J. P. Gaty's Brown 1, ne nw ne 30-26s-2e, 2½ mi w Greenwich, S. pl.	8-31-48	2961	2957- 2961	Burgess sd; Penn	P 3,000	....
Sumner	Corbin	Alpine O & Royalty Co's Douglas 1, cel se nw 23-34s-2w	8-17-48	4481	4475- 4480	Simpson sd; Ord	P 75	....
		KANSAS—New Gas Field						
Edwards	.....	Max Coben's Bright 1, nw nw sw 1-24s-16w	8-17-48	3985	3686- 3706	Lansing-KC li; Penn	15 mln	....
		NORTH LOUISIANA—New Distillate Pay						
Bienville	Driscoll	Barnsdall's Davis Bros Lbr Co 1, 125 w of c sw se 7-16n-4w	8- 3-48	11330	6760- 6840	Pettit li; L Cre	F 31; 3.2 mln; 11/64"	58
		SOUTH LOUISIANA—New Oil Fields						
Avoyelles	Marksville	Hunt Oil Co's Harry H. Edwards 1, 806.4 s 1267 e of swc, Sect 79 in 78-2n-4e, 3½ mi n Marksville.	8- 2-48	9117	7926- 7932	Wilcox sd; Eoc	F 180; 1/8"	48.

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss. Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

IN A MATTER OF MINUTES

TRAILERIG ....

The "Cardwell" Trailerig is a complete, self-contained, twin-engine drilling and servicing rig. It is fully portable without dismantling block, mast or engines. Recommended for drilling to 5,000' with 4-½" drill pipe and workover jobs to 10,000'.

The above sequence of photographs show an actual moving and rigging job in South Texas.

CARDWELL

REG U. S. TRADE MARK PAT. OFFICE

THIS TRADE MARK INSURES HIGHEST QUALITY AT LOWEST PRICE

CARDWELL MFG. CO. INC.

P. O. Drawer 2001 . . . Long Distance Telephones 128—129—130

Cable Address: "ALL STEEL," Wichita — "CARDSTEEL," New York

Wichita, Kansas, U. S. A.

WHEN IT'S A "CARDWELL," THERE'S NO EQUAL IN QUALITY

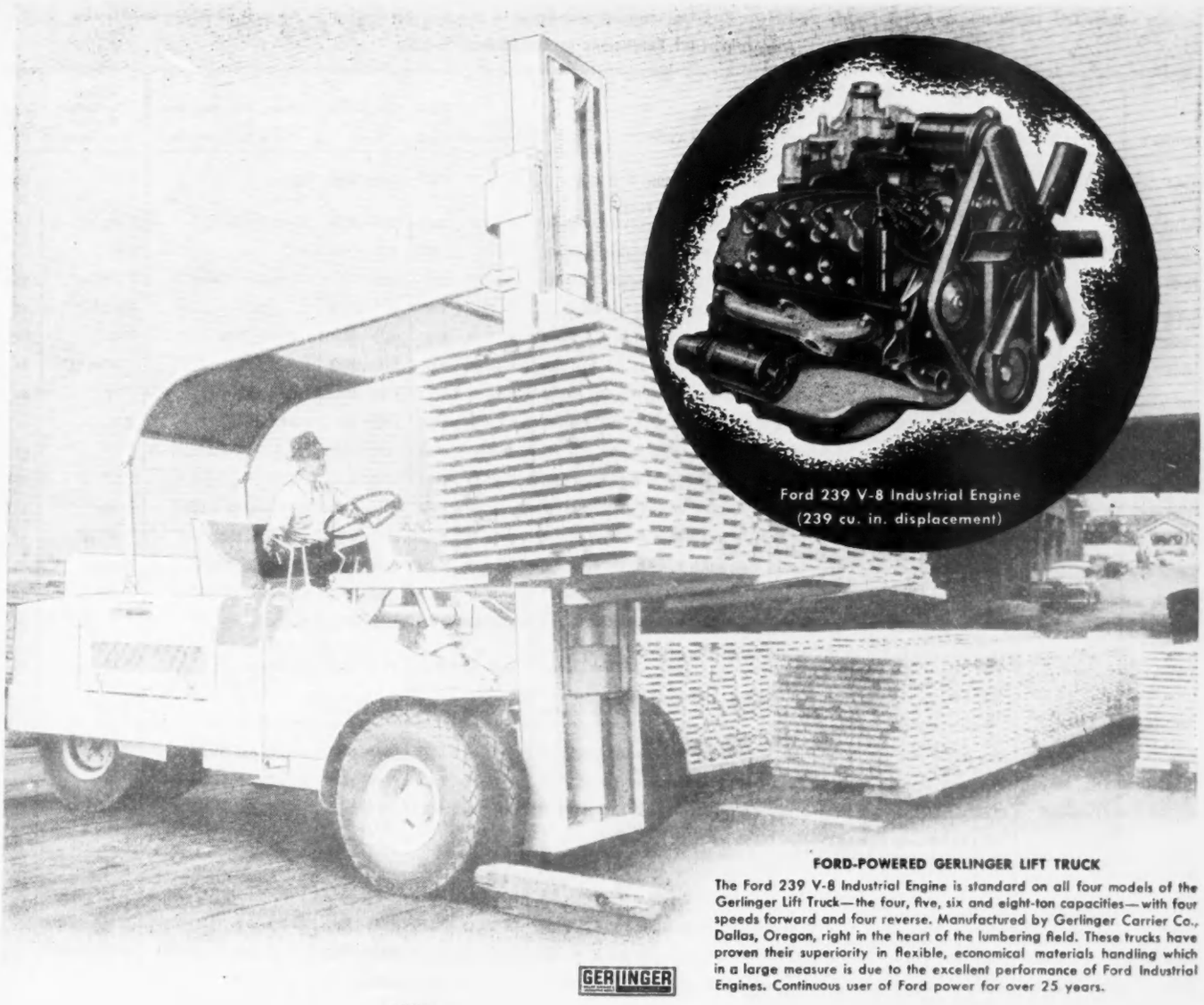
New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in August, 1948—Continued

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
Jefferson		Humble's State Lse 801-1, 660 s 660 w of nec Lse 801, Blk 10, Grand Isle Area. Gulf of Mexico.	8-11-48	8951	8640- 8665		F 840; 1/4"	30.9
Lafourche		Sun Oil Co's Lyric Rlty & Prkg Co 1, 1993 s 660 w of nec Sect 66-15s-15e. 1½ mi ne Chacahoula fld.	8-18-48	11131	10078-10090		F 166; 1/8"	34.6
Plaquemines	Main Pass	California Co's State Lse 1278-1, Blk 69, N. Pass Area, Gulf of Mexico. 6 mi e Delta Duck fld.	8- 9-48	9254	5858- 5867		F 216; 5/32"	26.2
Terrebonne	Bay Junop	Union Oil Co's State-LLE 1-9, 1450 s 885 e of nwc Sect 27-21s-14e	8-15-48	4777	4012- 4020		F 130; 3/4"	37.2
Terrebonne	Lake Hatch	Union Oil Co's LLE 1, 3355.6 n 3300 w of sec Sect 8-18s-16e, 7 mi sw Houma, S. fld.	8-11-48	11203	7896- 7902		F 235; 1/4"	35.7
		SOUTH LOUISIANA—New Oil Pays						
Avoyelles	Dave Haas	Atlantic Ref Co's Haas Inv. Co 11, swc Sect 10-2s-2e	8- 1-48	7797	7448- 7470	Sparta sd; Eoc	F 118; 5/32"	35.9
St. Charles	Good Hope	Pure Oil Co's GATX 6, Sect 7-12s-8e	8-14-48	9450	7750- 7772		F 298; 3/16"	45.7
		SOUTH LOUISIANA—New Distillate Pay						
Plaquemines	Point a la Hache	Sid W. Richardson et al's Delacroix Corp E-5, Sect 34-16s-14e	8- 1-48	11016	10142-10150		F 180; 1/4"	54
		SOUTH LOUISIANA—New Gas Field						
Terrebonne		Magnolia Pet Co's Ship Shoal 776-1, 4763 fr sl 7346 fr el Blk 72, 8 mi s Coon Point fld.	8-31-48	9355	7266- 7276		2 mln; 1/4"	
		MICHIGAN—Oil Field Extension						
Mason	Pentwater	Welsh Oil Co's Wright 1, ne se se 35-17n-18w, 1 mi nw extension	8-20-48	2106	2097- 2106	Dundee li; Devo	F 400	
		MICHIGAN—New Gas Field						
Missaukee		Gulf Ref Co's Alderman 1, sw nw ne 2-21n-6w, Clam Union twp	8-30-48	3859	-1489	Stray sd; Miss	0.2 mln	
		MISSISSIPPI—New Oil Field						
Wayne	Yellow Creek, E.	Walter E. Sistrunk's Ralph Stanley 1, 423 fr sl 230 fr wl ne nw 8-9n-7w, 2½ mi ne Yellow Creek fld.	8-14-48	5507	4845- 4938		P 182; 6 wtr	19.6
		NEW MEXICO—New Oil Pay						
Lea	Penrose-Skelly	Skelly Oil Co's R. R. Sims 7, Sect. 3-23s-37e	8-20-48	10204	6420- 6490	Drinkard sd; Perm	F 126; 1/4"	39.5
		OKLAHOMA—New Oil Fields						
Cleveland		Continental's J. Mauska 1, se se sw 16-10n-4w	8-20-48	9098	8145- 8250	Bois D'Arc li; Devo	F 195; 1½"	37.6
Cotton		Akin & Dimock's Taelee 1, 1100 s 220 e nw ne 12-2s-11w	8-26-48	2232	2222- 2232	Permian sd	P 25	34
Garvin	Hoover, NE	C. L. Carlock's Lewis Tuley 1, ne ne se 12-1n-1w	8-19-48	4628	4496- 4516	Deese sd; Penn	F 288; 1/4"	47
Garvin		Anderson-Prichard's Freeman 1, nw ne se 26-3n-2w	8-26-48	5645	5473- 5503	Deese sd; Penn	P 120	33
Grant		British-American's Corneil 1, ne ne nw 24-28n-3w. 2 mi s Webb pl.	8-26-48	4693	4685- 4693	Wilcox sd; Ord	F 178; 3/32"	45.6
Okfuskee	Haydenville, S.	Mid-Continent's Holderby 1, se ne sw 29-13n-10e	8-26-48	2926	2910- 2927	Gilcrease sd; Penn	F 1200; 1"	31
Stephens		Tom Palmer's Amerada 1, se ne nw 31-2n-5w	8-19-48	10144	10039-10078	Pennsylvania sd; Penn	F 25	35
		OKLAHOMA—New Oil Pay						
Pottawatomie	Keokuk, NE	John M. Halko's Irick "B" 2, sw se sw 12-11n-6e	8-25-48	4475	4191- 4208	Hunton li; Devo-Sil	F 4	
		OKLAHOMA—New Gas Fields						
Lincoln		Falcon Seaboard et al's Yancey 1, se se nw 26-14n-3e	8-26-48	4124	4110- 4112	Prue sd; Penn	4.2 mln; 1"	
Payne		Deardorf Oil Corp's Howell 1, sw ne se 14-17n-3e	8-26-48	3969	3904- 3936	Red Fork sd; Penn	4.7 mln.	
Pawnee		H. L. Wadsworth's Blanchard 1, se se nw 25-20n-6e	8-19-48	2703	2684- 2698	Skinner sd; Penn	3.5 mln	
		TEXAS—District 1 (SOUTH CENTRAL)—New Oil Fields						
Caldwell	"Kelly"	Kelton & Braselton's Chas. T. Kelley 1, 300 fr wl 150 fr sl 102-ac lse, R. B. Jarman Sur. 5 mi se Lockhart.	8- 4-48	2520	1922- 2070	Austin ch; U Cre	P 149	40.5
Milam	"Gause"	Standard of Texas's Lucinda Green et al 1, 330 fr sel 990 fr nel W. D. Thompson Sur. 3 mi w of Gause.	8-20-48	5747	5698- 5704	Edwards li; L Cre	P 30; 41 wtr	30
		TEXAS—District 2 (MIDDLE GULF COAST)—New Oil Field						
Victoria	Anaqua	Baldridge & King et al's May Ward Williams 1, 3920 fr nl 1189 fr el M. W. Williams Tr. S. Serna Gr.	7-16-48	5533	5529- 5533		F 88; 1/8"	33.4
		TEXAS—District 2 (MIDDLE GULF COAST)—New Oil Pay						
Goliad	Hords Creek	Brown & Wheeler's J. R. Kaufman D-6, Pedro Trevino Gr.	8-17-48	4960	4919- 4923	Cook Mountain sd; Eoc	F 130; 1/2"	47
		TEXAS—District 2 (MIDDLE GULF COAST)—New Distillate Field						
Live Oak		Continental's Clay West Burns Christenson 1, 2010 fr nel 2310 fr sel 2950 fr nwl Willis S. Novell Sur. 58.	8- 8-48	10313	7170- 7184		F 6; 0.6 mln	55
		TEXAS—District 2 (MIDDLE GULF COAST)—New Gas Field						
Victoria		Taylor Ref Co's Meta Hanselmann 1, 3400 fr swl 990 fr nwl Chas. Grenor Sur.	6-25-48	4743	4678- 4684		no gge	
		TEXAS—District 2 (MIDDLE GULF COAST)—Gas Field Extension						
Bee	Blanconia, S	Bridwell Oil's H. C. Wood B-1, 467 fr sl 2333 fr el 237.5-ac Lse, James McGeehan Sur.	8- 1-48	5806	5244- 5250		110 mln	
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Fields						
Madison	"Day"	Sun Oil Co's G. P. Day 3, 9049-ac Lse, John Crownover Sur. 2 mi w Madisonville.	7-25-48	2466	1903- 1908	Wilcox sd; Eoc	P 42	25.4
Matagorda		Rowan Drlg Co & Texas Gulf Prod Co's Guy F. Stovall et al 1, 467 fr s&el Sect 18, I&GN Sur, 5 mi n Midfield fld.	8-26-48	8760	6364- 6366	Frio sd; Olig	F 126; 1/8"	37.1
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Pay						
Liberty	S. Liberty	Sam Maceo et al's J. F. Richardson 1, 2350 fr el 50 fr sl 10-ac lse, M. G. White Sur.	8-24-48	4700	4430- 4434		F 92; 1/4"	36.1
		TEXAS—District 3 (UPPER GULF COAST)—Oil Field Extension						
Chambers	Cedar Point	Humble's Cedar Point State 7, 660 fr swl 1980 fr nwl Sect 127, 1¼ mi sw extension.	8- 9-48	7020	6058- 6078	Frio sd; Olig	F 52; 1/8"	35
		TEXAS—District 3 (UPPER GULF COAST)—New Distillate Fields						
Liberty		Wm. Hebert Hunt Tr Est's Welch & Silva 1, 2310 fr nl 330 fr wl Sect 11, T&NO Sur. 2 mi n Cottonwood fld.	8-25-48	8296	7908- 7926		F 78; 3.2 mln 1/4"	58
Newton	Gist, S	Houston Oil Co's Newton Co. Lbr Co 1, 466 fr el 1400 fr sl J. Harding Sur, 1¾ mi s Gist fld.	8- 4-48	7707	7556- 7580		F 20; 4.1 mln; 1/4"	
		TEXAS—District 3 (UPPER GULF COAST)—New Distillate Pay						
Orange	Pt. Neches, N.	Gulf Oil Corp's W. W. Kyle Sr 1, 867.75-ac Lse, Wm. Allen Sur.	7-22-48	10628	8980- 8990		no gge	52
		TEXAS—District 3 (UPPER GULF COAST)—New Gas Field						
Hardin		Houston Oil Co's Houston Oil & American Republics Fee 1, 1690 fr el E. Lubititit Sur. 660 n of nearest pt. on Village Creek.	8- 2-48	9386	8944- 8980		4.8 mln; 1/4"	
		TEXAS—District 3 (UPPER GULF COAST)—New Gas Pay						
Harris	Clinton	Stanolind's A. S. Moody 2, Reels & Trobough Sur.	8- 1-48	10001	8000- 8048	Cockfield sd; Eoc	11.5 mln	
		TEXAS—District 4 (LOWER GULF-S.W.)—New Oil Fields						
Brooks		Texas Co's Amanda C. Garcia et al 1, 2093 fr sl 4250 fr wl H&GN Sur 429. 1½ mi ne Fitzsimmons fld.	8-12-48	5041	4497- 4505		F 90; 1/8"	44.4
Duval	DCR 79	Magnolia's Duval Ranch 1, Sect 79, 330 fr sl 990 fr wl CCSD&RGNG Sur, 2½ mi w-nw Lundell fld.	8-18-48	2539	1476- 1490	Cole sd; Eoc	P 69	20
Hidalgo	"Payne"	Thomas O. Payne et al's D. J. Schwarz 1, 660 fr n&el Lot 3, Blk 25, Llano Grandt Gr, 2 mi s Lacy fld.	8-27-48	7615	7562- 7566		F 153; 11/64"	45.8
Jim Hogg	"Armstrong, S."	King & Daubert's E. L. Armstrong 2, 2900 fr el 990 fr sl J. S. Williams Sur. 2 mi s Armstrong fld.	7-25-48	3215	3209- 3215	Loma Novia sd; Eoc	F 99; 1/4"	27
		TEXAS—District 4 (LOWER GULF-S.W.)—New Distillate Pays						
Aransas	Fulton Beach	Placid Oil Co's A. C. Glass et al 2, Ocean Sect, Gilliland & Lockhart Sur.	8- 3-48	8254	8236- 8246		F no gge; 23.5 mln	
Brooks	Gyp Hill	Sun Oil Co's Lowe-Middlebrook Unit 1, 2800 fr sl 2200 fr wl Sobas Perez Sur 334.	8- 8-48	7208	7136- 7160		F 132; 3.8 mln	
		TEXAS—District 4 (LOWER GULF-S.W.)—New Gas Pay						
Starr	Rincon, N	La Gloria Corp's Dee Davenport-State 1, (OWWO) Santos Bazan Sur 514.	8-24-48	6511	3199- 3211		11 mln	
		TEXAS—District 4 (LOWER GULF-S.W.)—Gas Field Extension						
Jim Wells	Magnolia City	H. R. Smith-W. C. McBride Inc & Progress Pet. Inc's Paula V. de Garcia 1, R. J. Kleberg Sur 102, ⅗ mi e extension.	8- 8-48	6220	5636- 5646	Frio sd; Olig	12 mln	

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.



FORD-POWERED GERLINGER LIFT TRUCK

The Ford 239 V-8 Industrial Engine is standard on all four models of the Gerlinger Lift Truck—the four, five, six and eight-ton capacities—with four speeds forward and four reverse. Manufactured by Gerlinger Carrier Co., Dallas, Oregon, right in the heart of the lumbering field. These trucks have proven their superiority in flexible, economical materials handling which in a large measure is due to the excellent performance of Ford Industrial Engines. Continuous user of Ford power for over 25 years.

Be Right 3 Ways with FORD Industrial Power!

1 **Right Power!** Not just one, but your choice of five rugged workhorses in the new Ford Industrial Engine line. There's one tailor-made to fit your power needs.

2 **Right Features!** When you specify Ford Industrial Engines you can be sure your power source is right up to the minute, with all the latest features of Ford's progressive, "out front" engineering.

3 **Right Service!** Ford Dealers are everywhere, with the facilities and experience for keeping Ford Industrial Engines right on the job—for longer life, greater service, lower costs.

Ford For *more* power, *better* power—it's Ford. And now the famous Ford "Power-Family" boasts five rugged engines—a "four" of 120 cu. in. displacement . . . two "sixes"—226 cu. in. and 254 cu. in. displacement . . . two V-8's—239 cu. in. and 337 cu. in. Every one new all through—the power that's right for you! Full specifications on request by return mail. Send postcard today!

FORD MOTOR COMPANY

INDUSTRIAL AND MARINE ENGINE SALES DEPARTMENT

3524 Schaefer Road • Dearborn, Michigan

YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in August, 1948—Continued

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		TEXAS—District 6 (NORTHEAST)—New Oil Field						
Wood		Billy Birdwell & F. R. Jackson's McAlester-Atlatl 1, 1050 fr nl 1700 fr el J. Crawford Jr. Sur, 1 mi e Alba.	8- 1-48	4125	4052- 4090		P 48	15.3
		TEXAS—District 7-B (NORTH CENTRAL)—New Oil Fields						
Callahan		Ansac Oil Co et al's Fred Heyser 2, 2400 fr nl 2200 fr wl Wm. A. Smith Sur. 219. 10 mi n Cross Plains.	8- 4-48	3973	3940- 3970	Ellenburger li; Ord	F 98; ¾"	41.8
Eastland		Vim M. Gamblin's Jim Donaway 2, 460 fr sl 669 fr wl ne¼ Sect 3, Blk 2, BBB&CRR Sur, 1¾ mi s Dotham.	8- 4-48	368	356- 368		P 5	....
Eastand		Lone Star Prod Co's C. J. Kleiner "A" 2, 713 fr sl 330 fr wl n½ Sect 81, Blk 4, H&TC Sur, 2 mi n Cisco.	8-14-48	3927	3869- 3927	Mississippi li; Miss	F 118; ¼"	43.5
Erath		Haynes B. Ownby's W. C. Clayton 1, 832 fr el 350 fr sl 114.5-ac lse, D. J. O. Millard Sur. 2½ mi s Desdemona.	8- 4-48	3021	3011- 3018		F 57; ⅜"	42
Haskell		Thos. D. Humphrey's J. M. Collins et al 1, 2500 fr sl 1400 fr wl of e 640-ac of R. Brown Sur, Sect 157.	8-17-48	5541	4923- 4941	Caddo li; Penn	P 44	39.7
Jones		Sellers & Brown's W. D. Minter 1, 330 fr n&el Sect 42, Blk 15, T&PRR Sur, 3 mi n Hawley.	8-10-48	2032	2025- 2032		F 3520; 11/64"	38
Jones		Ungren & Frazier's J. Sellers 1, 850 e 330 n most s'ly nwc Wm Dlk Sur. 4 mi se Hawley.	8-24-48	1762	1755- 1762	Limestone	P 32	39
Jones		Danciger O&R Co's R. L. Stephenson 2, 1250 fr wl 10,150 fr sl M. Fragosa Sur. 3¼ mi ne Noodle.	8-18-48	5445	2925- 2928	Reef li; Penn	P 64	....
Shackelford		F. W. Peckham's L. A. Sanders 1, 150 fr e&sl of ne nw Sect 21, Blk 11, T&PRR Sur, 2 mi ne Albany.	8-10-48	600	590- 600		P 2	38
Stephens		Bailey Griffin et al's McClelland "B" 1, 330 fr e&sl of nw¼ Sect 463, SPRR Sur.	8-13-48	3968	3599- 3632		P 12	45
Stephens		Kadane Griffith Oil Co et al's Davis "B" 1, 467 fr n&wl Tr 4, Sect 9, Blk 8 T&PRR Sur, 12 mi e Albany.	8- 1-48	4458	4448- 4454	Ellenburger dolo; Ord	F 185; ⅜"	42.6
Taylor	"Gibson"	Geochemical Surveys et al's D. P. Moore 1, 330 fr s&el of n 80-ac of Lot 14, Lge 147, Grimes CSL. 1½ mi se Merkel.	8-24-48	2868	2552- 2560	Flippen li; Perm	F 90; 7/32"	41
Taylor	King	Sojourner Drlg Co Ltd's Sealy Smith Foundation 1, 330 fr s&wl Blk 9, Lge 146, Grimes CSL Sur. 3 mi s Merkel.	8- 9-48	2502	2500- 2502	Flippen li; Perm.	P 78	43
Throckmorton		R. S. Lesage's Wm. McKeichan 1, 500 fr nel 875 fr nwl CIR Sur, Blk 4, 13 mi sw Throckmorton.	8-31-48	4510	4480- 4510	Mississippi li; Miss	F 300; ¼"	44
Throckmorton		Fred M. Manning, Inc's Roy H. King Tr. 1, Sect 268 BBB&CRR Sur. 8 mi n Throckmorton.	8-31-48	5240	4695- 4710	Caddo li; Penn	F 192; ¼"	42
		TEXAS—District 7-B (NORTH CENTRAL)—New Oil Pay						
Taylor		West Central Drlg Co et al's Ennis Reidenbak 2, 330 fr n&el Lot 13, Lge 146, Grimes CSL, 10 mi s Merkel.	8-25-48	2676	2664- 2676	Limestone	P 120	40
		TEXAS—District 7-B (NORTH CENTRAL)—New Gas Field						
Throckmorton		Henshaw & English's D. W. Key 1, 475 fr nl 1866 fr el of W. E. Crump Sur, 12 mi s Throckmorton.	8- 5-48	758	751- 758		15 mln	....
		TEXAS—District 7-C (WEST CENTRAL)—New Oil Fields						
Coke		Alan Guiberson's Lassiter 1, (OWWO), 660 fr wl 1980 fr el Sect 308, Blk 1-A, H&TC Sur, 3 mi nw Sanco.	8-11-48	6528	6501- 6514	Marble Falls li; Penn	F 319; 25 wtr	47
Coke		Hickock & Reynolds' E. C. Rawlings 1, 660 fr nl 1980 fr wl Sect 453, Blk 1-A, H&TC Sur, 1 mi w Bronte.	8-10-48	5802	4348- 4356	Palo Pinto li; Penn	P 73	44
Runnels	"Freeman"	Geochemical Survey's J. W. Freeman 1, 660 fr s&wl Sect 357, Thos R. Webb Sur, 4½ mi sw Crews.	8- 1-48	3405	3390- 3405		P 48	40
		TEXAS—District 8 (WEST)—New Oil Fields						
Andrews		Continental's Univ C-25-1, 1980 fr n&wl Sect 25, Blk 14, Univ. Lds.	5-28-48	4770	4725- 4770	San Andres li; Perm	P 5	32
Andrews		Stanolind's Lotus Oil "F" 1, 660 fr n&el Sect 18, Blk A-48, PSL Sur, 14½ mi nw Andrews.	8- 7-48	7021	6860- 6870		P 21; 97 wtr	33
Crane	"C-Bar Connell"	Gulf Oil Corp's Connell et al "G" 1-SI-C, 1985 fr sl 1982 fr el Sect 27, Blk B-22, PSL Sur.	8-27-48	9575	8305- 8320 9520- 9575	Fusselman li; Sil Connell sd; Ord	F 397; 11/64" F 116; ½"	39.6 42.8
Ector		Cities Service's Foster 1, 660 fr nl 1980 fr wl Sect 9, Blk 43, T3S, T&P Sur, 2½ mi sw Cowden, S. fld.	8-18-48	4410	4065- 4215	Grayburg li; Perm	F 249; 25 wtr; ½"	35.1
Ector		Humble's Yarbrough & Allen 4, 2357 fr nl 576 fr wl Sect 31, Blk B-14, PSL Sur, 3½ mi s Yarbrough & Allen fld.	8-24-48	10800	10620-10643	Ellenburger dolo; Ord	F 95; 19 wtr	39.7
Gaines	"Jenkins"	Texas Co, Humble & Ralph Lowe's Jenkins et al 1, 662 fr sl 660 fr wl Sect 4, Blk A-25, PSL Sur, 6 mi n Union fld.	8-19-48	9505	9100- 9135	Devonian li	F 175; 43 wtr; ¼"	27
Lubbock		Stanolind's J. F. Stinnett 1, (OWWO) 660 fr s&wl Lab 18, Lge 4, San Augustine CSL.	8- 7-48	7000	4685-		P 75; 61 wtr	26.5
Pecos	"Heiner, N."	Humble's Alma D. Unsicker et al 1, 1980 fr ne&sel Sect 15, Blk 10, H&GN Sur, 2 mi sw Pecos Valley pl.	8-19-48	8460	5630- 5660		P 67; 14 wtr	39.4
Winkler	"Keystone, S."	Gulf's Keystone Cattle 125-T, 1980 fr s&el Sect 29, Blk B-2, PSL Sur.	8- 1-48	11502	6470- 6590	Tubb li; Perm	F 162; ½"	34.6
		TEXAS—District 8 (WEST)—New Oil Pay						
Crane	Block 31	Atlantic Ref Co et al's Univ 2-A-31, Sect 33, Blk 31, Univ. Lds.	8-24-48	11645	10170-10190	Waddell sd; Ord	F 159; ¼"	43.8
		TEXAS—District 8 (WEST)—Oil Field Extension						
Hale	Petersburg, W.	Humble's T. E. Lutrick 1, 660 fr nl 1980 fr wl Sect 17, Blk O-8, EL&RR. 1 mi sw extension.	8- 3-48	8065	7945- 8065	Cisco li; Penn	P 28	40.5
		TEXAS—District 8 (WEST)—New Gas Field						
Andrews		Sinclair Prairie's J. Stevenson 1, 1980 fr n&el Sect 13, Blk A-36, PSL Sur.	8-14-48	10490	2945- 2985		1.4 mln	....
		TEXAS—District 9 (NORTH)—New Oil Fields						
Archer		S. D. Johnson et al's J. L. Prideaux 1, 330 fr n&el Sect 1868, TE&L Sur, 8 mi sw Windthorst.	8-14-48	3017	3007- 3017		P 74	42.7
Archer		G. E. Kadane & Sons' Wilson "AA" 2, 380 fr nl 1749 fr el Blk 126, ATNCL Sur, 1½ mi se Holliday.	8- 4-48	1082	1077- 1082		P 17	40.2
Clay		Grace & Grace's Otis Smith 1, 1263 fr nl 330 fr el H. Tucker Sur. 1 mi nw Shannon.	8-26-48	5515	5420- 5470	Caddo li; Penn	F 1112; ½"	42.6
Cooke		Atlantic Refg Co's Jno Rivoire 1, 467 fr s&wl SA&MG Sur, 5½ mi se Marysville.	8- 1-48	3758	3745- 3754	Ellenburger (?) li; Ord	P 17	26
Jack		Jack Grace's Jack Grace Ranch 1, 330 fr nl 467 fr wl of Lse, C. J. C. O'Connor Sur, 3½ mi se Cundiff.	8- 4-48	5375	5330- 5375	Bend cgl; Penn	P 168	42
Young		Goodstein & Gerdon's J. M. Golden 1, 444 fr n&el Blk 25, Young CSL Sur, 2 mi e Walsh fld.	8- 9-48	3720	2602- 2624		P 35	40
Young		Ben Rankin et al's Clark Est. 1, 1400 fr nl 370 fr wl Chas. Newhas Sur. 1 mi nw of prod.	8-31-48	4465	3972- 3992		F 30; 7/64"	41
Wichita	"Lake Wichita Caddo"	Consolidated Oil Co's Alice Daves 3, 330 fr sl 990 fr wl Blk 14, Lge 2, Denton CSL Sur, 7 mi sw Wichita Falls.	8-12-48	5198	5184- 5198	Caddo li; Penn	F 1050; ¾"	42
Wichita		W. H. Hammon & Warren O Corp's T. J. Cole "A" 2, 1263 fr n&wl Blk 10, Palo Pinto CSL Sur, 6 mi n Holliday.	8-20-48	2964	2952 -2964	Canyon sd; Penn	F 1486; ¾"	44
		UTAH—New Gas Field						
Grand		Frontier Ref. Co's Gov't-Crittenden 1, c se se 12-17s-25e, Prairie Canyon.	8-31-48	4497	3605- 3610	Basal Morrison sd; Jur	3.8 mln	....
		WEST VIRGINIA—New Gas Field						
Wood		Columbian Carbon Co's Leslie Thompson 1069, Steele Dist. 1½ mi ne of prod.	8-26-48	4913	4845- 4847	Oriskany sd; Devo	4.9 mln	....
		WYOMING—New Oil Field						
Niobrara		Pacific Western's Grimes-Gov't. 1, nw nw se 31-39n-61w, Bridge Creek Sector.	8-23-48	2595	2538- 2574	Fall River (Dakota) sd; U Cre	P 198	35
		WYOMING—New Gas Field						
Fremont		Sand Draw Oil Co's Unit 2, ne ne nw 26-32n-95w.	8-31-48	8959	3720- 3781 3865- 3884	1st Frontier sd; U Cre 2nd Frontier sd; U Cre	5.2 mln	....

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

Causes and Prevention of Drill Pipe and Tool Joint Troubles

By H. G. TEXTER
Spang-Chalfant, Inc., and
R. S. GRANT
Hughes Tool Company.
Revised by H. G. TEXTER, Chief Field Engineer, Spang-Chalfant Division of The National Supply Company, and S. C. MOORE, Product Engineer, Hughes Tool Company

THIS IS THE FIRST of a series of articles which revises a widely acclaimed paper presented under the same title before the American Petroleum Institute's Twenty-Second Annual Meeting at San Francisco on November 6, 1941. To give readers both the new thoughts on the subject and also the benefit of the very thorough discussion presented in the original manuscript, the old text is reprinted in full in our standard type and revisions indented in larger type. The effective revision date is August, 1948.

Reprints of the series in pamphlet form will be available following completion of publication in WORLD OIL. Those desiring reprints should request copies as soon as possible.

ABSTRACT

THE AUTHORS DESCRIBE drill pipe and tool joint troubles and means of preventing them.

It is stated that true twistoffs, spiral tears, and tension failures have been practically eliminated by improved pipe manufacturing and drilling practices. Failures at the last-engaged thread and leakage through threads also have been practically eliminated through improvements in design and in installation methods.

Fatigue breaks are the most common type of drill-pipe trouble today. They may be pure fatigue failures, but much more often are accelerated by notches or scars and by corrosion. Fatigue breaks may be reduced greatly by the use of adequate drill-collar weight, and this is probably the most important recommendation that can be made to increase the life of drill pipe.

Troubles arising from worn pipe can be prevented best by keeping the pipe straight. Pipe usually is made crooked by running the string in compression. Collapsed pipe, although rare, usually occurs while making drill stem tests.

Wall eccentricity, internal erosion, and magnetism, although often discussed, have never been proved to be causes of drill pipe failures.

Longitudinal splitting of the pipe ends of tool joints has been practically eliminated by the use of upset forgings. Splitting or swelling of the pin and box ends can be prevented by the use of special lubricants.

Galling and wabble failures are the two most common tool-joint troubles today. The former can be prevented best by careful breaking in and adequate lubrication.

Wabble failures result from operation of the joint while loose, and are aggravated by the modern practice of running drill strings in tension. They can be prevented best by adequate tonging and by care in handling to prevent damage to shoulders.

Tool joint wear cannot be prevented, but the effects and costs entailed can be minimized by the use of easily replaceable tool joints, oversize tool joints or wear subs, and by resleeving or hard-surfacing of either the tool joints or subs.

Part 1

THIS paper outlines practically all the principal types of drill pipe and tool joint failures. When the cure is known, practical ways of eliminating the trouble are explained in detail. When no complete cure has been found, acceptable ways of reducing the trouble are explained, if known. The paper is based upon many years of experience in the study of drill stem failures by the writers and by their operator friends.

The plan of this paper is to discuss drill pipe and tool joint failures, point by point, taking up the more obvious troubles first and then proceeding through the more obscure causes of failures. To complete the picture it is thought worthwhile to include brief discussions of early troubles—even though they now are almost nonexistent—with modern manufacturing and drilling practice.

As a matter of information, references to pertinent papers are given in the bibliography.

Drill pipe is discussed first, because its varieties of troubles are more numerous.

DRILL PIPE

1. True Twistoffs

The term "twistoff" is used, erroneously, in the field for any type of failure in which the pipe becomes broken, or parted by any cause whatsoever. Its true meaning should be a failure of drill pipe due to pure torsion.

In the early days of rotary drilling, when fishtail-type bits were used almost exclusively, and when drill pipe was made of softer steel, failures resembling true twistoffs occasionally occurred

FIGURE 1
"Wrapping-up" of drill pipe from excessive torque load

FIGURE 2
Spiral tear from excessive torque load

when the bit got caught and the table continued to rotate. Even under such circumstances, the failure is not one of pure torsion; because the pipe, being unconfined, could buckle and "wrap up" before parting.

An example of this "wrapping up" is shown in Figure 1.

Today rock bits are used, except in relatively soft formations, and bits almost never hang up so abruptly that the table cannot be stopped before failure occurs. Also, drill pipe seldom is manufactured in softer than grade "D" steel, and its torsional strength is so great that it cannot be "wrapped up" by torque exerted in ordinary drilling.

2. Spiral Tears

Spiral tears also represent a type of failure which is practically nonexistent today, and which at no time was very common. It is illustrated in Figure 2.

A spiral tear is another form of torsional failure occurring when the bit gets hung up and the table continues to turn. It could happen only if the pipe were rather closely confined, inside of casing—and then only if there already had been a transverse crack or deep transverse scratch in the body of the drill pipe. With such conditions, under heavy torsional stress, the crack or scar tears into a very uniform spiral, as shown in Figure 2. The spiral is always right-hand (for right-hand table rotation) and bears no relation to any possible lines of weakness in the body of the pipe. In fact, modern seamless drill pipe is so manufactured that any lines of weakness are in a slow (long-pitch) *left-hand* spiral.

3. Tension Failures

Before the days of dependable weight indicators it was fairly common to part stuck strings of drill pipe. The lower tensile strength of earlier drill pipe steel was, of course, a contributing factor.

The parting of stuck strings of drill pipe represents pure tension failures, preceded by an appreciable necking down of the weakest length, somewhere near the top of the string (see Figure 3).

Even today, when drill pipe is stuck, it sometimes will be pulled on beyond the yield point in desperation, or because the weight indicator is out of adjustment. Naturally, however, it is seldom actually parted.

If a drill string is suspected of having been pulled beyond the yield point, all the upper part should be examined closely to see whether the lengths have been stretched. This can be done by comparing the "before and after" length tally or by checking the outside diameter with calipers. Dangerous elongation can be detected readily, and such lengths discarded.

However, it is hard to define "dangerous" elongation. One operator has reported stretch in a stuck string amounting to 2 feet per 30-foot length. After having discarded only the few lengths in which he could determine a necking down on the diameter, the balance of the stretched pipe gave satisfactory service. Undoubtedly such lengths were considerably work-hardened as in cold-drawn wire, and would be less ductile than normal pipe. Also, there is danger that the stretch has not been as uniform as it seems, which would give an area of very low ductility. So, it would be good practice to discard all stretched lengths, or at least to degrade them to less severe drilling.

When drilling at depths of 10,000 feet and deeper, danger of tension failure can be minimized by using heavier-weight drill pipe in the upper part of the string, or by buying special high-tensile pipe of better than grade "D" physical properties.

Grade E, adopted by the API, is now in general use in wells around 10,000 feet and more in depth. Also, since wells between 15,000 to 20,000 feet are being drilled or contemplated, most manufacturers are experimenting with steels having minimum yield strengths of 95,000 to 105,000 psi. One manufacturer, for example, is furnishing drill pipe made of SAE 4340 having the following physical properties:

Yield Strength (Min., psi)	105,000
Tensile Strength (Min., psi)	125,000
Percent Elongation in Two Inches (Min.)	16

If heavier weight drill pipe is used in the upper part of extra long strings, or if a higher grade is used, the upper part should have a larger outside diameter to avoid the danger of mixing pipe. Combination strings such as the latter actually are being used in California and in the Mid-Continent.

Once in a very great while drill pipe

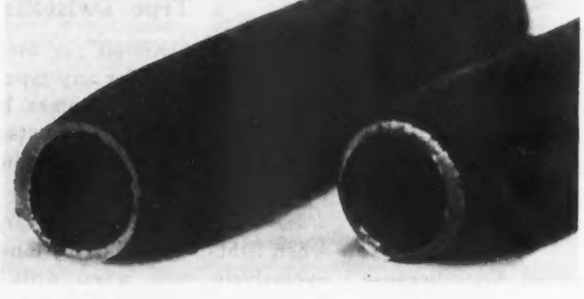


FIGURE 3
Pure tension failure of drill pipe

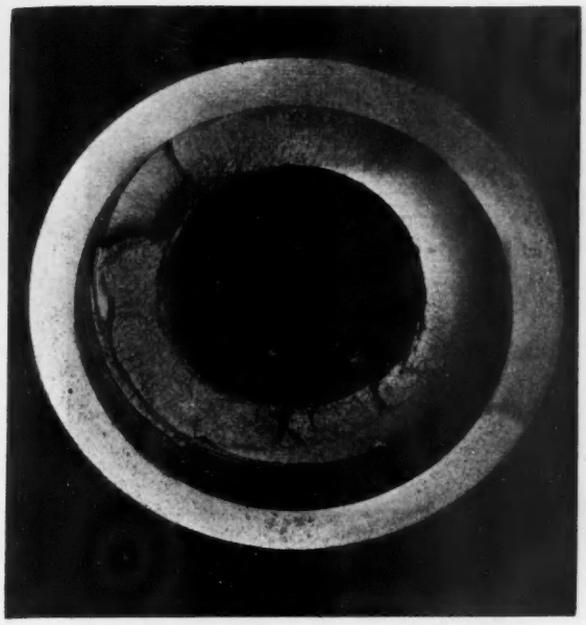


FIGURE 4
Complete failure in last engaged thread

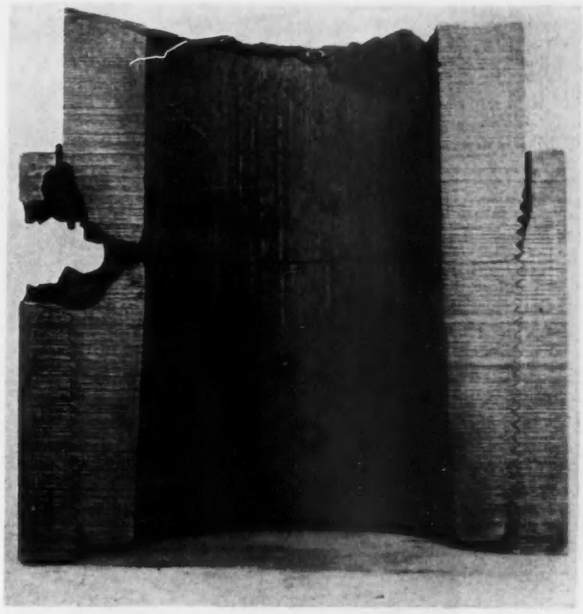


FIGURE 5
Incomplete failure in last engaged thread, showing effect of mud cutting.

will fail from tension after partly having failed from another cause, such as bending fatigue, for example. In such a case there will be a section of the break in which the wall is of normal thickness, with an almost square fracture, but with the balance necked down and elongated irregularly as in the case of pure tension. Usually, however, a fatigue crack continues to tear after it once has started.

4. Last-engaged Thread Failures

When API tool joints are screwed onto API pipe, with sufficient torque to insure against leakage or unscrewing, and when this madeup element is subjected to bending or vibration stresses, as in drilling, there are almost *certain* to be many fractures through the upsets. These fractures invariably start as transverse cracks, at the bottom of the last-engaged thread of the pipe (counting the thread at the small end of the pipe as the first thread). The crack is the result of stress concentration due partly to the compressive effect of the tool joint concentrated at the bottom of a notch (thread), and partly to the resistance to bending imposed by the relatively heavy mass of the tool joint which is gripping the pipe (note also Section 6-b).

The rapidity with which last-engaged thread cracks develop is determined by the frequency of stress reversals—which, in turn, is governed in part by the speed of rotation. This type of failure seems to be affected mostly by vibration, as the trouble is encountered almost exclusively in rock-bit drilling; but occasionally occurs in fishtail drilling, immediately above the drill collar, when there is considerable bending from the pipe being in compression.

In further proof that vibration is a major factor in this trouble are the following facts:

Straight holes give more trouble than crooked ones. In fact, last-engaged thread failures were never very serious until straight-hole specifications were put into drilling contracts. Crooked holes, evidently, damp the vibrations.

Drilling inside large outside-diameter surface casing causes more failure than in smaller casing.

Also lighter muds, or clear water, give more trouble than viscous drilling fluids, the latter having more damping effect.

A surprisingly large percentage of these failures occurs under the box ends of tool joints—which seems to mean that vibrations, traveling up from the bit, momentarily are halted by the heavy weight of the box tool joint and produce stress reversals at the root of the last-engaged thread.

These failures are most numerous when the drill pipe is in at least occasional compression, but often occur far up in a string where the pipe is always in tension.

A few isolated cases are known of last-engaged thread failures that apparently have been caused during straightening of short kinks in drill pipe just above the point where gripped by the rotary slips. This might be due to one of the straightening-machine anvils having been placed on the end of the tool joint; but it is not certain whether the bending stress, thus imposed, actually caused the failure or simply aggravated a crack already started in drilling service.

Last-engaged thread failures are aggravated by corrosion, and many persons believe that this is the most important factor of all. In part proof of this point is positive elimination of the trouble by the very light bead of metal now employed in welding the tool joints to the pipe. The mechanical strength of the weld cannot be high, but it does keep all corrosive fluids away from the first exposed thread root.

Figures 4 and 5 illustrate last-engaged thread failures, both as they occurred and as sectioned in the laboratory. Sometimes, as in Figure 5, the break has not proceeded entirely around the pipe, but has allowed mud to cut through and erode holes through the tool joint.

Today there are many patented drill pipe tool joint connections on the market in which the effect of a stress-concentration point at the root of a thread has been eliminated. Some of these bridge over the last threads of the pipe by allowing the tool joint recess to land on a machined surface on the pipe, beyond the threads. Some connections effectively employ square threads which eliminate the notch effect of API threads. Others eliminate a threaded connection altogether by making the tool joint integral with the pipe, as by upsetting or by welding.

All of the designs, including welding API tool joints to the pipe, have eliminated last-engaged thread breakage to such a large degree that it may be considered as a thing of the past, and this phase of drill pipe trouble well may be relegated to ancient history.

5. Leakage Through Threads

Also as past history may be included leakage between drill pipe and tool joint threads. Aside from having been practically eliminated by the greater accu-

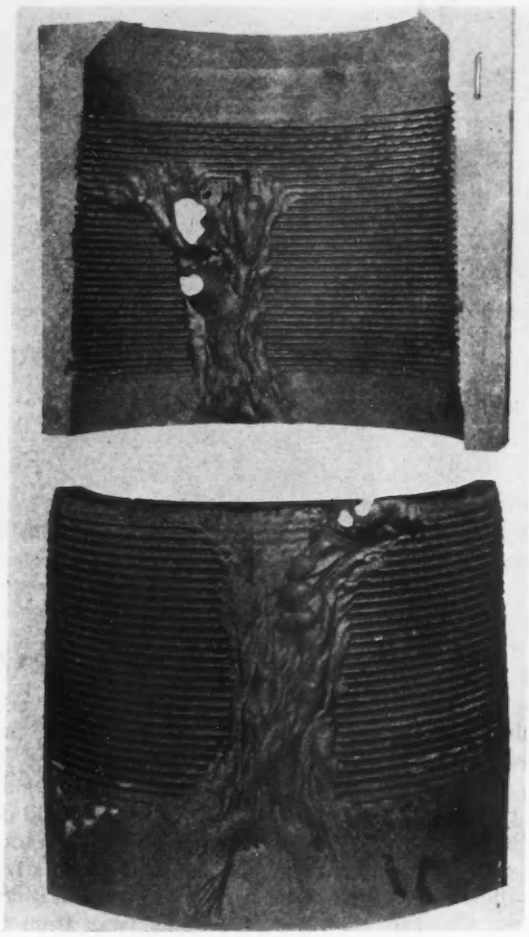


FIGURE 6
Effect of leakage through threads due to tool joint threads being mismated with pipe threads.

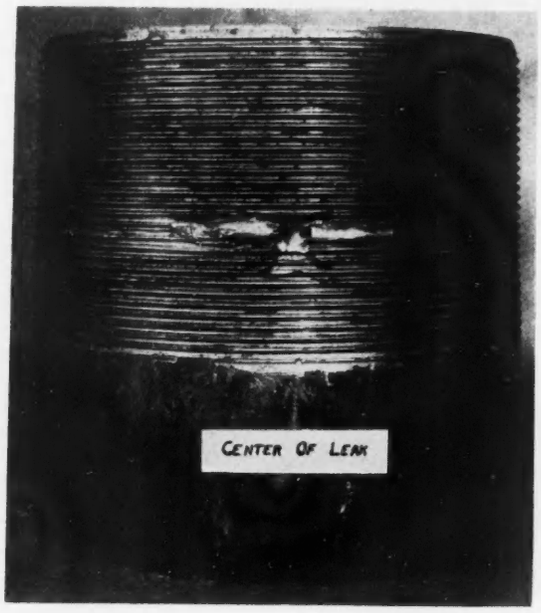


FIGURE 7
Leakage through threads due to galling

racy of modern API threading specifications, the general practice of having all tool joints screwed on in a mill, or shop, and of welding the tool joints to the pipe, plus the introduction of patented connections, eliminates leakage entirely as a present-day trouble.

Figure 6 shows the effect of mud leakage when a tool joint was mated improperly with its pipe thread. Galling, incidentally, was once a prime factor in causing leaky connections (see Figure 7). It still occurs occasionally, but can be attributed usually to damage to pipe threads in handling.

6. Fatigue Breaks

Fatigue breaks are by far the most common drill pipe failures known both in early and present drilling practice. However, they are often the least understood by those in the field.

For one thing, the field classification of this general type of failure is incorrect to start with. If the failure is incomplete, i.e., when a fatigue crack does not travel on around to complete failure, but is discovered as a hole in the pipe, it is called a "washout"; and when it is a complete failure, a square break, or nearly so, it is called a "twistoff." Not only are these terms erroneous, but they definitely mislead the observer as to the cause.

Long study of field troubles has led to one very positive and invariable conclusion: that there *cannot* be a "washout" —in the sense that the drilling fluid has cut its way through the wall of the pipe— without there being some sort of starting hole. Therefore, a "washout" is not a hole *washed* out through the pipe, but is a crack (usually a fatigue crack) which has formed under *mechanical* stress, but which has been enlarged and rounded off at the edges by the eroding action of the mud stream.

All drill pipe is made by the seamless process, and the very nature of this piercing process is such that a defect in the billet which would result in a hole entirely through the wall is a physical impossibility. The expansive force required to convert a solid steel billet into a tube by piercing is great enough to tear open even a minor defect in the billet—and, instead of a tube, it would emerge from the piercing mill as a ribbon. Actually the seamless process is the most effective method ever discovered of inspecting large tonnages of steel. Thus there are several reasons for being positive that all "washouts" are simply enlarged fatigue cracks.

Another erroneous impression in connection with fatigue is the idea that the steel has "crystallized." Actually there has been no change whatsoever in the size of the crystals. They simply have broken down, across their crystal planes, and the resultant fracture has a "brittle" appearance to the naked eye, which has led to the thought of "crystallization." Elsewhere, even at the very edge of the original crack, as well as at any other location in the failed length, the metal is perfectly normal except for a very small amount of work-hardening.

Fatigue breaks can be subdivided into three classes: *a*, pure fatigue; *b*, notch fatigue; and, *c*, corrosion fatigue. Of these the first one is the least common.

6-a. Pure Fatigue

Whenever steel is subjected to cyclic stress of sufficient magnitude—whether in tension, compression, torsion or bending—it will fail ultimately by fatigue fracture. Inasmuch as bending and direct tension are by far the most common critical stresses applied to drill pipe, they alone need be studied in detail.

The simplest illustration of bending fatigue is that of breaking a nail by gripping it in a vise and bending it back and forth with a hammer. Anyone knows that the farther it is bent, at each blow, the sooner it will break. But what is not known by everyone is that hammer blows which do not put a permanent bend in the nail may still break it if repeated often enough. However, if the stress set up by the hammering back and forth is below a certain figure—different for different grades of steel—the nail never will fail. This critical stress,

CHAIN BELT COMPANY

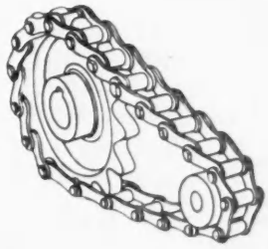
is pleased to announce

the appointment of

THE CONTINENTAL SUPPLY CO.

as another distributor for their

Oil Field Chains



Both Rex A.P.I. Chains and Baldwin-Rex Roller Chains

will be available at all

THE CONTINENTAL SUPPLY CO.

Store Points.

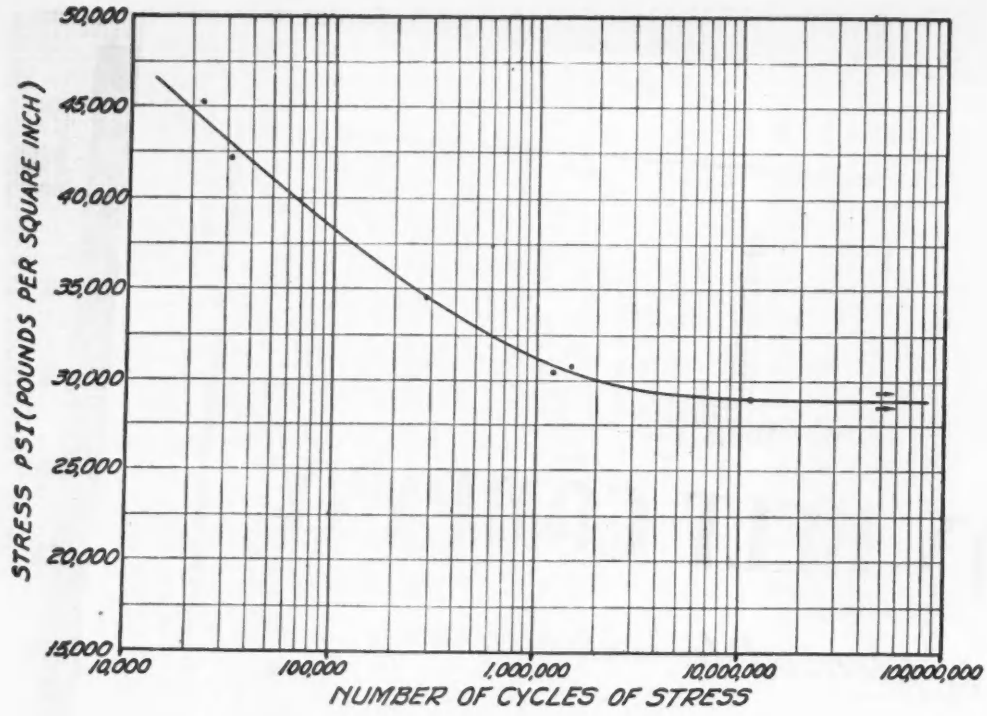


FIGURE 8
Typical "S-N" curve for low-carbon steel.

measured in pounds per square inch, is called the "endurance limit" of that particular steel.

Thus, if an ordinary 0.10-percent carbon-steel nail be bent back and forth so that the maximum stress is less than 28,000 psi, it may be bent back and forth billions of times without causing fracture; but if the stress is above this figure, the nail eventually can be fractured, and the number of times it need be bent (the number of stress cycles) decreases as the stress increases.

This is illustrated in Figure 8, which is a simple example of an "S-N" curve (stress plotted against number of stress cycles to produce failure). It shows that, if the stress is low enough, the nail never will break; but if the stress is raised to, say, 30,000 psi, the nail will fail at about two million cycles. If the stress is raised to 33,000 psi, the nail will fail at only 500,000 cycles; and if raised to the elastic limit, the nail will break almost immediately. Thus, only a few blows of a hammer are required to break a nail when it is bent back and forth in a vise through a considerable arc, because the stress is then above the elastic limit, or at least 48,000 psi in Figure 8.

Drill pipe can, and occasionally does, fail from pure fatigue; but this is rare, because other factors, such as outside scars or corrosion, are usually contributory.

Figure 9 is an example of pure fatigue in 5-9/16-inch drill pipe. The fatigue occurred in a new string of pipe—with rock-bit drilling—on its first well, and under circumstances which could be determined definitely and studied.

Drill pipe fails so seldom in its early life that a complete service history cannot be obtained. After the first well, the lengths lose their identity and their relative position in the string, so that not even a guess can be made as to the nature of the stresses to which they were subjected.

The failures illustrated were two of five lengths that failed so early in the first well that even much of the original outside mill scale could still be seen near the tool joints. Therefore, there was little doubt that all five never had been moved from their original position in the string, just above the drill collars.

Briefly, it was established definitely that all five failures were the result of bending stresses due to the pipe having been run in compression. The compressive load was not enough to put a permanent bend in the lengths, but was probably just short of that stress. In other words, on the "S-N" curve for this particular steel the stress was so near the elastic limit that only a very few million stress cycles were needed to cause fracture.

Right here it might be noted that drill pipe rotating at 100 rpm makes 144,000 revolutions per day if left on

FIGURE 9
Example of pure fatigue failure in drill pipe

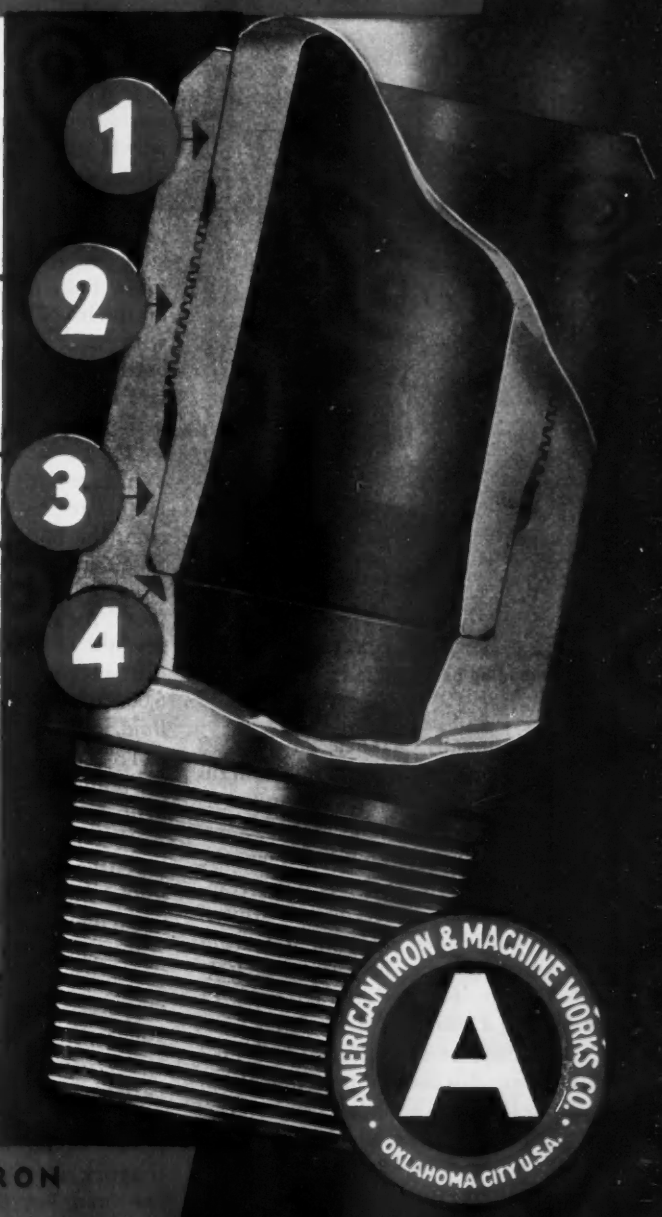
AMERICAN IRON 4 POINT PROTECTION!

STABILIZER SEAL---

Plus **THREAD SEAL-----**

Plus **INSIDE SEAL-----**

Plus **SHOULDER SEAL-----**



Here's real protection against joint leakage in your drilling string! American Iron's advanced, simplified design for these *Straight Grip* Tool Joints provides an *inside seal* . . . giving you *four* sealing areas! Furthermore, this simplified design so controls the reduction of area that the *seal becomes tighter* as high tension loads and pump pressure *increase!* Repeated tension tests prove that these tool joints are *three times* as strong as the drill pipe they connect!

Designed right; made right; and installed right . . . these *Straight Grip* Tool Joints lead the field for simplicity of design — and efficiency of performance!

AMERICAN IRON & MACHINE WORKS CO. · A · OKLAHOMA CITY U.S.A.

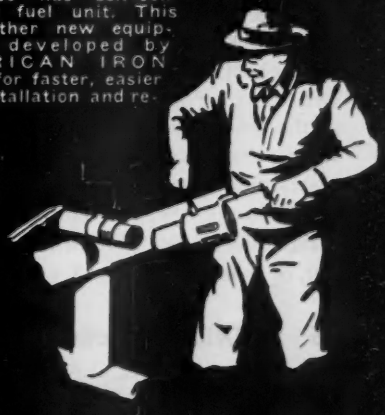
YOU GET ALL 4 IN AMERICAN IRON

Straight Grip TOOL JOINT

THREE TIMES AS STRONG AS THE PIPE THEY CONNECT

SIMPLIFIED Field Installation and Removal

Our new type, portable furnace has self-contained fuel unit. This and other new equipment developed by AMERICAN IRON makes for faster, easier field installation and removal!



AMERICAN IRON & MACHINE WORKS CO.

Oklahoma City, Okla.—Box 1177—Phone L. D. 518
Dist. Office, Houston, Texas
Export Office: 420 Lexington Ave., New York City, N. Y.

Also manufacturers of A. P. I. and "Amweld" (counterbore weld) Tool Joints

FIGURE 10
Peened over elevator shoulders due to drill string pounding back and forth in the hole.

bottom continually. Hence, in just 10 days there could be more than a million stress cycles imposed on the pipe.

Once the fracture had started, mud began to erode and smooth over the sharp edges of the crack; but the fracture rather quickly proceeded on around the pipe, and ended up with a tearing action which left the lip shown in Figure 9. This lip is very characteristic of pure fatigue failures in drill pipe.

Examination of the failures described hereinbefore disclosed no evidence of any corrosion, or scarring, or slip marks, or any surface defects which could have given a starting point for fracture. Hence the justification for calling this "pure" fatigue.

Further justification is the position of the breaks, with respect to the tool joints. All five of these breaks were within 8 inches to 15 inches of the tool joint (3 boxes and 2 pins)—which is just about where bending stress would be highest. The tool joint is the "vise" and the pipe is the "nail," and just as in the case of bending the nail to failure the fracture occurs somewhere near the restraining member. Therefore, it is almost always true that failures from pure fatigue occur just beyond the upset run-out, or from 7 inches or 8 inches to about 20 inches from either the tool joint box, or pin.

Evidence that the pipe really was being bent back and forth is the rather remarkable peening over of the elevator shoulder which can be seen in Figure 10. All three of the box-end failures showed this, and it is clear that this was caused by the lower end battering against the formations. And, because the tool joints were getting such a battering, the body of the pipe must have been swinging violently back and forth in the (9⅝-inch) hole, cocking the tool joints, shown exaggerated in Figure 11, and setting up the bending-stress cycles which finally reached the endurance limit of the steel.

A remedy for the foregoing trouble is to keep the drill pipe definitely in tension, by adding enough drill collars to more than equal the maximum weight on the bit. This is exactly what was done with this 5-9/16-inch string, and the breakage stopped *until* several of the collars were removed. Then two more failures occurred, but again were stopped by the replacing of the collars.

In calculating the amount of drill collar needed to keep the drill pipe in tension, the buoyancy of the mud must be taken into account. In 9.4-pound mud (approximately 70 pounds per cubic foot), for example, steel loses about one-seventh of its weight. Or, a 7,000-pound drill collar assembly would weigh only 6,000 pounds suspended in the drilling fluid.

To have 15,000 pounds on a bit in a 9.4-pound mud, the actual weight of the drill collars, reamers, etc., would need to be 15,000 pounds divided by six-sevenths, or 17,500 pounds. In heavier muds the increased drill collar weight needed would be proportionately greater.

But, using 17,500 pounds would place the neutral point (neither tension nor compression) right at the top of the drill collars, and there would be no leeway for errors in the weight indicator or for careless handling of the brake lever. Therefore, to *insure* that the drill pipe never would be in compression, good practice is to ignore the buoyancy of the mud but to run 50 to 100 percent more drill collar weight than the highest weight ever carried on the bit. Thus, for 15,000 pounds on the bit, in order to keep the drill pipe definitely in tension, the weight above the bit, drill collars, reamers, etc., should be 22,500 pounds to 30,000 pounds.

Occasionally pure fatigue failures seem to occur in the upper part of a string where the length of pipe always had been in tension. However, if all facts were known, it is more than likely that the length had formerly been run in compression, on a previous well, and had already reached the fracturing point.

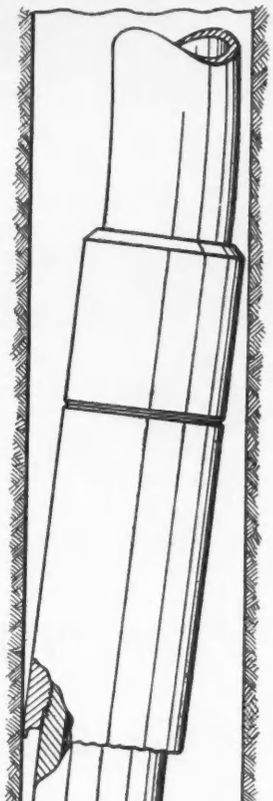


FIGURE 11
Exaggerated bending of pipe, explaining peening over of tool joint shoulder.

Also, it is pretty definitely established that a crooked kelly can cause bending in the first length of drill pipe, below the kelly sub, and might cause a fatigue failure. Even having the crown block off center would throw some bending stress in the kelly and pipe.

A final point in connection with fatigue is the relative resistance to failure of internal-upset and external-upset drill pipe. Inasmuch as it already has been pointed out that the tool joint (and upset end of the pipe) is the "vise" and the drill pipe is the "nail," it must be evident that the more immovable the vise, the quicker the nail can be broken. Therefore, the larger and heavier the upset (and tool joint), the greater the stiffness of the restraining member will be, and the quicker the adjacent pipe can be broken. This fact is being borne out in the field, and indicates that internal-upset drill pipe is preferable to the external-upset type unless the latter is needed for greater fluid passage. In other words, the lower the stiffness of the joint, the less the danger of fatigue fracturing the pipe.

(To be continued next month)

The Relation of Nozzle Fluid Velocity to Rate of Penetration with Drag-Type Rotary Bits

Part 2
(CONCLUSION)

By J. P. NOLLEY, GEORGE E. CANNON and DOUGLAS RAGLAND
Humble Oil & Refining Company

The Effect of High Nozzle Fluid Velocity on Bit Design

An attempt to drill a complete 8⅝-inch hole in a Sugar Valley field well with a nozzle fluid velocity near 300 feet per second, while using two-way, standard curved bladed bits equipped with alloy steel nozzles directed to the blades was not successful because of excessive fluid erosion of the nozzles, as illustrated in Figure 13. A switch to tungsten carbide nozzles resulted in erosion of the bit blades as shown in Figure 14. Tungsten carbide nozzles directed ahead of blades were therefore adopted in order to eliminate all erosion; straight blades were substituted for curved blades in order that the nozzles could be directed as far ahead of the blades as possible in the limited space available.

A study of the effect of blade angle and nozzle direction on the rate of drilling was conducted in the Truitt and Gravier 1 well, Sugar Valley Field, Matagorda County, Texas, where 75-foot intervals of uniform shale, as located by an electric log of an offset well, were drilled with bits equipped with nozzles directed to various points in front of standard curved blades and straight blades. The nozzles were directed to the same location on the bottom of hole, approximately one inch from the wall, regardless of how far in front of the blade they were directed. The results of the tests conducted in the Truitt and Gravier 1, as shown in Table 5, indicate that, from the standpoint of drilling rate, the straight bladed bit with nozzles directed ahead of the blades is as good, or better than, the standard curved bladed bit equipped with nozzles directed to the blades.

It had not been determined, however, whether straight-bladed bits equipped with nozzles directed ahead of the blades would perform satisfactorily at low nozzle fluid velocities near 100 feet per second. To determine this, a portion of the 8⅝-inch hole was drilled with bits equipped with nozzles directed 1½ inches ahead of straight blades in the King Ranch Borregas 33 well, Borregas field, Kleberg County, Texas, at an average nozzle fluid velocity of 90 feet per second. When the drilling with the straight bladed bits is compared in Table 6 with the drilling of the standard curved bladed bits in the King Ranch Borregas 19 well 6,500 feet away, where equal circulating rates, nozzle sizes, and drilling techniques were used, the straight bladed bits with nozzles directed ahead of the blades performed better than the standard bits.

As an aid in finding the most advantageous direction for drag bit nozzles, chip formation studies were conducted in clays of various hardness and in paraffin. Typical chips are shown in Figures 15 and 16 for clay and in Figure 17 for paraffin. It is noted that the chips are similar in nature and tend to curve upward and away from the blade. The

TABLE 5
Effect of Nozzle Direction and Blade Curvature on Drilling Rate

TRUITT AND GRAVIER 1
(Feet Drilled - 75 Per Bit)
MATAGORDA COUNTY, TEXAS (GULF COAST)

BIT NO.	DIRECTION NOZZLES WITH RESPECT TO BLADES	DEPTH FROM	DEPTH TO	DRILLING TIME-MIN.	CIRCULATING RATE-GPM	NOZZLE FLUID VELOCITY	HYDRAULIC HORSE-POWER	DRILLING RATE FT./HR.
1	*Tangent and Parallel	6,175	6,250	56.0	608	318	605	80
2	*1 1/2-inch in front	6,250	6,325	19.9	592	309	588	226
3	*3/8-inch in front and Parallel	6,325	6,400	18.2	592	309	588	247
4	*2 1/2-inch in front	6,400	6,475	22.1	592	309	605	204
5	*3/8-inch in front and Parrallel	6,475	6,550	28.4	592	309	605	158
6	*1 1/2-inch in front	6,550	6,625	16.6	592	309	613	271
7	*Tangent and Parrallel	6,625	6,700	14.1	592	309	588	319
8	**Standard	6,700	6,775	27.7	578	302	574	162

*Straight Blade
**Curved Blade

NOW AMERICAN IRON SPECIAL *Straight Grip* TOOL JOINTS FOR DRILL COLLARS

Installed by Hand . . . Removed by Hand at the job site!

Here they are! Replaceable drill collar connections with ALL the advantages of our Straight Grip Tool Joints for drill pipe, PLUS these three additional features:

(1) POINT OF FLEXIBILITY . . . American Iron Engineers have so designed this area to attain flexibility which dampens transverse and longitudinal vibrations.

(2) REVERSE TAPERED SECTION . . . This reverse taper produces flexibility to section of drill collar a sufficient distance from *straight grip area* so as to eliminate *fatigue* breaks!

(3) FATIGUE GROOVE . . . This fatigue groove permits the face of stabilizer seal to breathe, thus eliminating pure fatigue at *critical* section.

Remember, American Iron engineering of these *three vital areas* eliminates breakage from torsional fatigue, high compression or tension loads! Also note that the tool joint O.D. is *always* the same as the drill collar!

American Iron *Straight Grip Drill Collar* Connections can be machined in any well equipped oil field machine shop, by following the simple machining and gauging practices established by American Iron Engineers. American Iron & Machine Works Co., Oklahoma City, Oklahoma — Box 1177 — Phone L. D. 518 — District Office, Houston, Texas. Export Office: 420 Lexington Ave., New York City, N. Y.

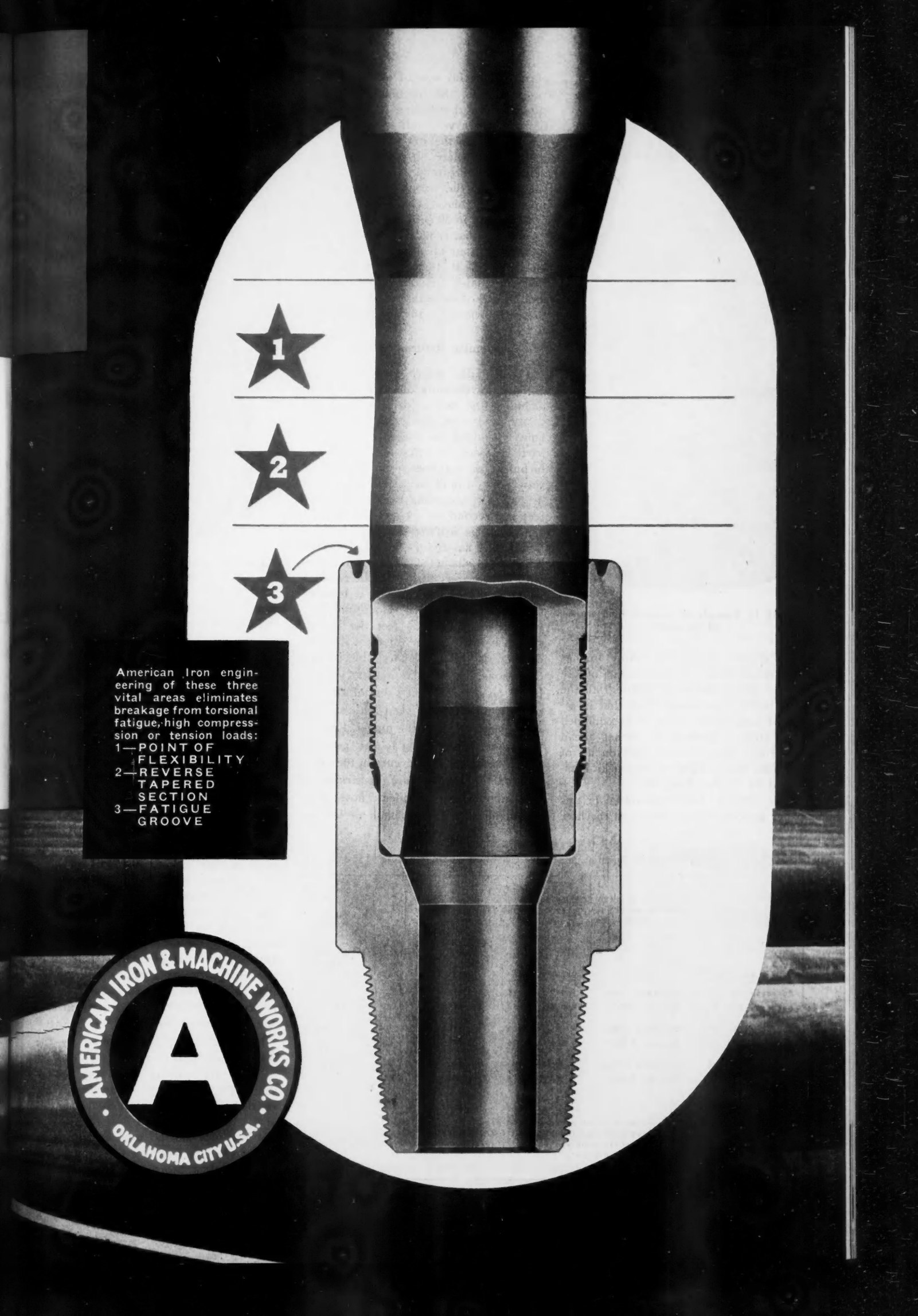

1
2
3
American Iron engineering of these three vital areas eliminates breakage from torsional fatigue, high compression or tension loads:
1—POINT OF FLEXIBILITY
2—REVERSE TAPERED SECTION
3—FATIGUE GROOVE
AMERICAN IRON & MACHINE WORKS CO.
A
OKLAHOMA CITY U.S.A.

FIGURE 12. Example of excessive fluid erosion of bit nozzle.

chip studies, Figure 15, show further that nozzle fluid directed ahead of the blades should break or disintegrate the chip better than nozzle fluid that is directed toward the blade. Bits equipped with nozzles directed 1½ inches ahead of straight blades were used on all of the high nozzle fluid velocity tests illustrated by Tables 3 and 4.

The drilling tests summarized in this paper indicate that washing out the hole ahead of the bit was of minor importance and that the bit blades were responsible for the drilling of the formation, except in very soft formation near the surface. In the soft formations near the surface where no weight could be detected on the weight indicator during the drilling, the formation was found to wash out ahead of the bit as much as three feet in 30 seconds. However, in formations that required weight to drill, no washing out ahead of the bit could be detected. It is, therefore, believed that the major function of the nozzle fluid is the disintegration of the chips that are formed by the bit blades.

Annular Return Velocity

The annular return velocity needed for drilling depends on several factors including the rate of drilling, mud viscosity, and sloughing tendency of the hole. Formulas for the slip velocity of particles were presented by Pigott.[4] The turbulent or maximum slip velocity in water of a round flat particle 0.5 inch in diameter, according to Pigott, is 0.90 feet per second, or 54 feet per minute. Inasmuch as drilling cuttings are predominantly flat and are usually less than 0.5 inch in diameter, and drilling mud with a greater lifting capacity than water is normally in use, it is believed than an annular return velocity at some value greater than 54 feet per minute should be satisfactory for most drag bit drilling. In Humble's drag bit drilling operations, an annular return velocity based on a theoretical value of 200 feet per minute has been used with success. It is believed that the upper limit of usable return velocity is the point at which turbulent flow occurs in the annular space. Any increase in circulating rate above the turbulent flow point would increase the problem of lost returns because of the rapid increase in pressure on the formation.

FIGURE 13. Example of excessive fluid erosion of bit blade.

Many articles appear in the published literature as to the importance of drilling mud control in rotary drilling. Most of the work which has been done on drilling mud is concerned with the relation of mud properties to problems such as blowouts, lost returns, heaving shale, and filter cake formation.

It has been reported that drilling mud in any form retards the rate of penetration obtainable with rock bits in the hard formations encountered in the Permian basin of Texas and New Mexico.[5,6] Observations have indicated that the same is true for certain types of drag bit drilling under specified operating conditions. However, no data are available concerning tests that have been conducted to determine the effect of variation in the properties of water-base mud on the rate of drilling with drag bits. Special muds, such as silicate-base and oil-base muds, have been observed to accelerate the rate of drilling in certain shale formations.

Mud viscosities as measured by the conventional methods, i.e., with a Stormer viscosimeter or Marsh funnel, vary over wide limits. However, these viscosity defferences largely disappear at the turbulent rate of flow obtained in the drill pipe and bit nozzles. Figure 17 shows the effect of rate of shear as obtained with a Stormer viscosimeter on

TABLE 6
Effect of Nozzle Direction and Blade Curvature on Drilling Rate

AVERAGE CIRCULATING RATE-590 GPM
AVERAGE NOZZLE FLUID VELOCITY - 90 FEET PER SECOND
KLEBERG COUNTY - SOUTHWEST TEXAS AREA

WELL & NO.	BIT NO.	BIT TYPE	FROM	TO	HOLE DRILLED -FEET	NET ROTATING TIME -HOURS	DRILLING RATE FT./HR.
Borregas 19	142	Standard 2-Way[a]	2,049	4,825	2,776	45.23	61.37
Borregas 33	1	Special 2-Way[b]	2,050	4,836	2,786	40.13	69.42
Borregas 19	3	Standard 2-Way	4,902	5,230	328	15.50	21.16
Borregas 33	1	Special 2-Way	4,897	5,235	338	5.98	56.52
Borregas 19	485	Standard 2-Way	5,345	5,798	453	20.94	21.63
Borregas 33	2	Special 2-Way	5,323	5,788	[c]354	15.45	22.91

[a]Curved blades with nozzles directed to blades
[b]Straight blades with nozzles directed 1-1/2-inchs in front of blades.
[c]Because of two drill pipe washouts, 111 feet of hole and 4.85 hours were omitted from interval.

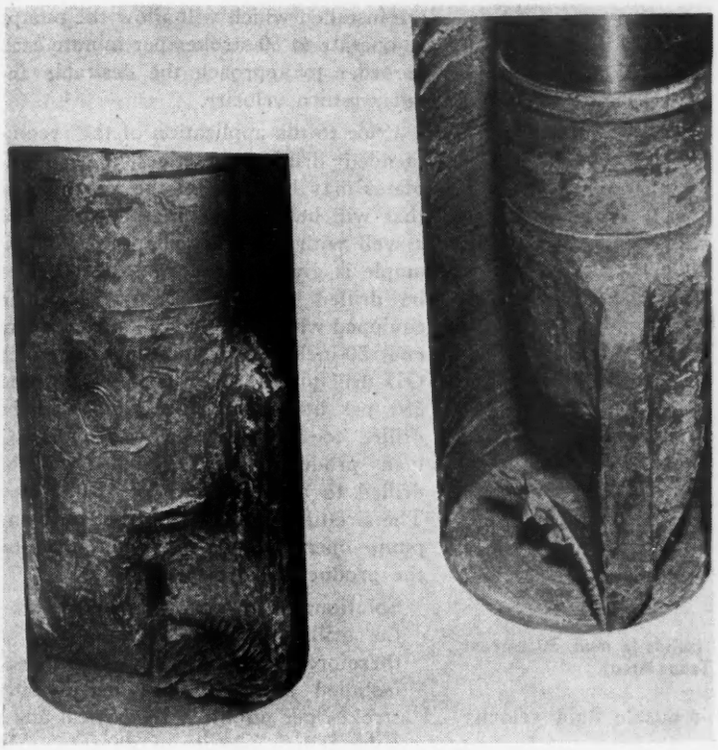


FIGURE 14. Generation of drag-type bit chip in clay formation at drilling rate comparable to 250 feet per hour at 150 rpm.

FIGURE 15. Relation of fluid nozzle discharge to chip generated by drag-type bit modified for high nozzle fluid velocity drilling.

the viscosity of two different samples of drilling mud. It is noted that the mud weighing 10.1 pounds per gallon attained a minimum viscosity of approximately 6 centipoise at 300 revolutions per minute, and the mud weighing 16.4 pounds per gallon attained a minimum viscosity of approximately 27 centipoise at 350 revolutions per minute on the stormer viscosimeter. If these viscosity values are substituted in the equation for determining pressure loss in pipe at various rates of flow, values are obtained far in excess of actual measured values. This leads to the conclusion that the effect of agitation on mud viscosity as it is circulated through 4½-inch OD or five-inch OD drill pipe is greater than the maximum obtained with a Stormer viscosimeter.

Since the measurable viscosity differences in drilling muds largely disappear under conditions of use in the drill pipe, it is felt that mud viscosity contributes a negligible amount to the drilling rate obtained with drag bits. This is assuming that a rate of mud circulation sufficiently high to produce turbulent flow in the drill pipe is employed.

It is frequently stated that the rate of drilling with drag type bits is retarded at extremely high mud weights. When drilling in abnormally high pressure formation areas, precautions which slow down the drilling rate are usually employed. Also, as the pressure drop in the circulating system is proportional to the mud density, the change from a normal to a high weight mud results in a reduction in the mud volume circulated, unless provisions are made to increase the circulating capacity of the mud pumps. This reduction in mud circulating rate, and not necessarily the change in the mud weight, can contribute considerably to the reduced drilling rate.

It has been reported that the rate of drilling can be affected by the chemical constituents of the drilling fluid;[7, 8, 9] however, there are no data available concerning work which has been carried out on this particular phase of the problem.

To gain full advantage of either increasing circulating rate or bit nozzle fluid velocity, it has been shown that the bit weight must also be increased. To overcome the possibility of deviated holes, Humble used 270 feet of 6¾-inch OD by 2 13/16-inch ID drill collars having a total weight of 27,000 pounds during the tests shown in Tables 3 and 4. The tests show a slight trend toward greater deviation with increased bit weights, but the deviation of the wells was within acceptable limits and does not vary appreciably from the average deviation for other wells that have been drilled using a smaller amount of bit weight.

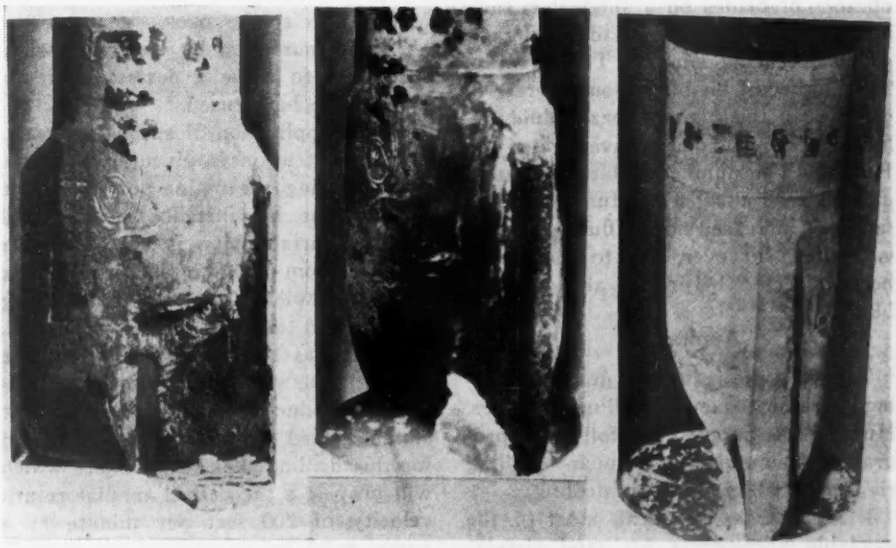


FIGURE 16. Generation of drag-type bit chip in paraffin formation at drilling rate comparable to 280 feet per hour at 150 rpm.

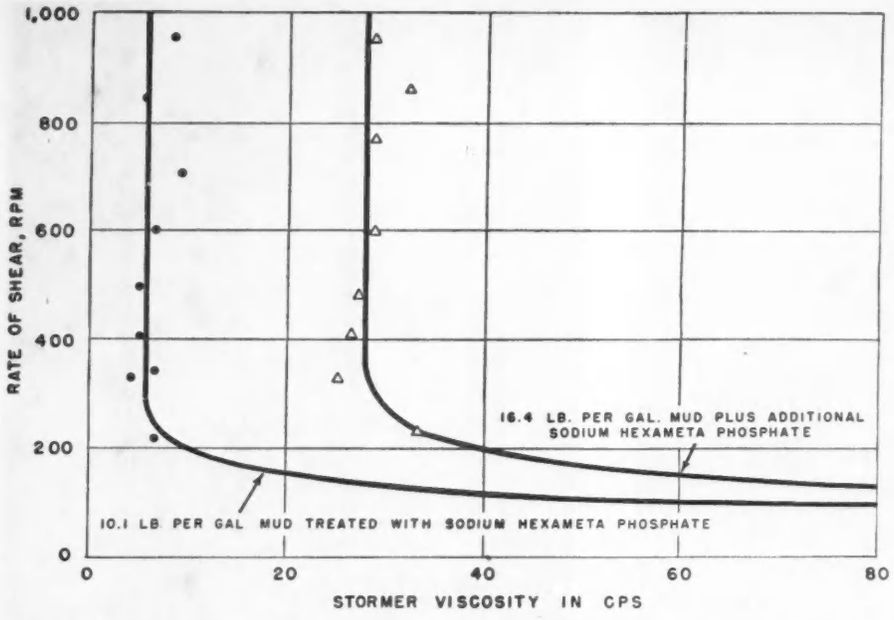


FIGURE 17. Effect of rate of shear on viscosity of natural shale mud (solids in mud, 30 percent; sample obtained from L-Ranch 8-15 well—Gulf Coast, Texas Area).

The drilling tests that are summarized in this paper were conducted at rotary speeds that are normally accepted as good practice by drillers. The rotary speeds varied between 100 and 175 revolutions per minute, with the greater speeds being used with the faster rates of drilling. It is known that there is a definite relationship between speed of rotation and rate of drilling with drag type bits; furthermore, it is realized that vibration of the drill stem and heating of the bit when higher speeds of rotation are used limit the maximum rotary speed that may be employed. Tests are now in progress to establish a more exact relationship of rotary speed with rate of drilling and to determine practical upper limits of speed for drag bit drilling.

Another factor that will influence the rate of drilling and bit life as well is the number of blades on a single bit, since a greater number of blades offers a greater wearing surface. The effect of the number of bit blades on the rate of drilling at the higher nozzle fluid velocities is now being investigated by Humble. The number of bit blades that may be used along with Humble's adaptation of increased nozzle fluid velocities is limited, however, due to the nozzle being directed 1½-inches ahead of the blade.

Application

To apply the results of drag bit drilling research to actual drilling practices, Humble has adopted the following program on a number of company drilling rigs engaged in drag bit drilling:

1. As near as practical, most of the available horsepower for mud circulation above the amount required to supply a safe annular return is applied to increasing the bit nozzle fluid velocity.

2. Straight bladed bits equipped with a single tungsten carbide nozzle directed 1½ inches ahead of each blade are used for all two-bladed bit requirements in 12¼-inch, 9⅞-inch, and 8⅝-inch hole. The nozzles are round and vary in ID by ⅛-inch from ½ to 1⅛ inches.

3. Unless justified by unusual hole conditions, the annular return velocity is maintained as close as practical to a theoretical value of 200 feet per minute with a minimum of 175 feet per minute.

4. Pump liners are used that will provide the required annular return velocity at 50 strokes per minute, except where the minimum sized nozzles are used and the pump or pumps will operate in excess of 55 strokes per minute. In such instances, larger liners are installed. A minimum sized liner of 6½ inches ID is recommended for pumps in the 18- and 20-inch stroke sizes.

5. The maximum bit weight possible so as not to cause a deviated hole or ball up the bit is used.

In the application of such a program, primary attention is given to the hole size requiring the major portion of the drilling time. For instance, in most field drilling, surface pipe is set at depths varying from 1000 to 4000 feet, after which the hole for the production string is drilled to the total depth of the well. Inasmuch as the major portion of the drilling time will be consumed in drilling the production string hole, the most suitable sized pump liners are installed for this drilling; i.e., pump liners which will provide a theoretical annular return velocity of 200 feet per minute at a pump speed of 50 strokes per minute. In the larger, surface hole, the pumps are operated in parallel, and bit nozzles are installed which will allow the pumps to operate at 50 strokes per minute each in order to approach the desirable annular return velocity.

Prior to the application of the recommended drilling practices, close estimates may be made of the nozzle sizes that will be required in the drilling of a well with any particular rig. An example is given as follows: A well is to be drilled to 10,000 feet with a rig equipped with an 18-inch diameter steam end, 20-inch stroke mud pump, 5-inch OD drill pipe (4½ IF tool joints), and 350 psi boilers. Surface hole will be drilled to 3000 feet, below which 9⅞-inch production string hole will be drilled to a total depth of 10,000 feet. The size of the rig is such that only one pump operation can be maintained on the production string hole.

Solution: The major portion of the drilling will be 9⅞-inch hole; therefore, pump liner sizes will be installed so as to provide at 50 strokes per minute a theoretical annular return velocity of 200 feet per minute in the 9⅞-inch hole. Volume calculations show that 592 gpm will supply the desired annular return velocity. The volume per stroke required for the pump would be 592 divided by 50, or 11.84 gallons. At 90 percent volumetric efficiency and 2¾-inch rods, the nearest sized pump liner available would be 7¼-inch ID, which would deliver 11.94 gallons per stroke.

The determination of the size of nozzles to use in the 9⅞-inch hole is illustrated in Figures 18 and 19. In Figure 18, the performance curve of the 18- x 7¼- x 20-inch steam pump is plotted in conjunction with the pressure drop in the circulating system of the rig when two ⅝-inch nozzles are in use, and in Figure 19 the performance curve of the same pump is plotted in conjunction with the pressure drop in the circulating system when two ¾-inch nozzles are in use. The performance curve of the pump was determined by drawing a straight line between the stall pressure of the pump based on a steam header pressure of 330 psi (20 psi lower than boiler pressure to allow for steam line pressure drop) and the operating pressure at 50 strokes per minute based on 65 percent stall pressure and 90 percent volumetric efficiency. In Figure 19, it can be seen that the ⅝-inch nozzles can be used to an approximate depth of 7000 feet, at which depth the annular return velocity will have decreased to the minimum recommended rate of 175

feet per minute. Below 7000 feet, two ¾-inch nozzles should be used since this is the next larger sized nozzle that is used in Humble's drilling program. In Figure 18, it can be seen that the ¾-inch nozzles could be used satisfactorily to the total depth of the 10,000-foot well and even at depths in excess of 14,000 feet.

Should the size of the rig be such that two 18- x 7¼- x 20-inch pumps are operated in series, the operating pressure of the two pumps would be twice the amount shown in Figures 18 and 19. Thus, smaller sized nozzles could be used through the same depth of hole intervals when compared with a single pump operation.

Conclusions

Within the limits of this investigation, where two bladed drag type bits were rotated at speeds of from 100 to 175 revolutions per minute in drilling 8⅝-inch to 12¼-inch holes in the Texas-Louisiana Gulf Coast areas at maximum efficient bit weights up to 40,000 pounds, it was found that:

1. Drilling rate is directly proportional to nozzle fluid velocity.

2. Drilling rate is directly proportional to circulating rate.

3. The maximum rate of drilling with two-way drag bits is obtained when the maximum weight just short of balling up is applied to the bit; at bit weights below the balling up point, rate of drilling is proportional to bit weight at constant speed of rotation.

4. The maximum rate of drilling with any rig can be obtained when all horsepower available for mud circulation is utilized in such a manner that a maximum value of the product of rate of circulation and bit nozzle fluid velocity is obtained. The rate of circulation so determined may be used in practice only when it is equal to or greater than the minimum rate required to produce a safe annular return velocity.

5. The use of drag type bits having more than two blades, the use of rotation speeds greater than 175 revolutions per minute and the economics of extreme nozzle fluid velocity drilling are worthy of investigation. The usefulness of much of the data presented in chart form may be extended when it is reduced to generalized equations.

ACKNOWLEDGEMENT

The authors sincerely appreciate the help and fine cooperation on the part of members of the Petroleum Engineering Division who assisted in gathering data, and particularly on the part of the district and drilling rig personnel concerned with running the many special tests required. Several manufacturers gave invaluable assistance in producing bits of special designs on short notice and in providing facilities for carrying out the studies on the cutting action of bit blades. Appreciation is also extended to the management of Humble Oil & Refining Company for permission to publish this paper.

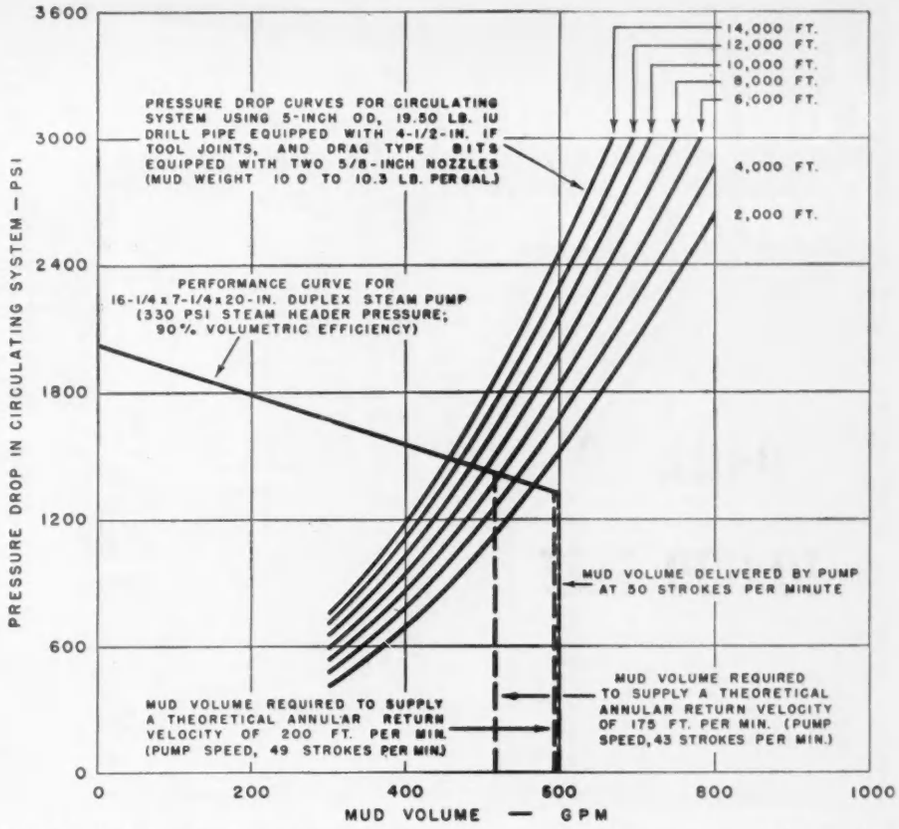

PRESSURE DROP CURVES FOR CIRCULATING SYSTEM USING 5-INCH OD, 19.50 LB. IU DRILL PIPE EQUIPPED WITH 4-1/2-IN. IF TOOL JOINTS, AND DRAG TYPE BITS EQUIPPED WITH TWO 5/8-INCH NOZZLES (MUD WEIGHT 10.0 TO 10.3 LB. PER GAL.)
PERFORMANCE CURVE FOR 16-1/4 x 7-1/4 x 20-IN. DUPLEX STEAM PUMP (330 PSI STEAM HEADER PRESSURE; 90% VOLUMETRIC EFFICIENCY)
14,000 FT.
12,000 FT.
10,000 FT.
8,000 FT.
6,000 FT.
4,000 FT.
2,000 FT.
MUD VOLUME DELIVERED BY PUMP AT 50 STROKES PER MINUTE
MUD VOLUME REQUIRED TO SUPPLY A THEORETICAL ANNULAR RETURN VELOCITY OF 200 FT. PER MIN. (PUMP SPEED, 49 STROKES PER MIN.)
MUD VOLUME REQUIRED TO SUPPLY A THEORETICAL ANNULAR RETURN VELOCITY OF 175 FT. PER MIN. (PUMP SPEED, 43 STROKES PER MIN.)
PRESSURE DROP IN CIRCULATING SYSTEM — PSI
3600
3000
2400
1800
1200
600
0
0
200
400
600
800
1000
MUD VOLUME — GPM

FIGURE 18. Method for determining size of nozzles to use in 9⅞-inch two-way drag type bits.

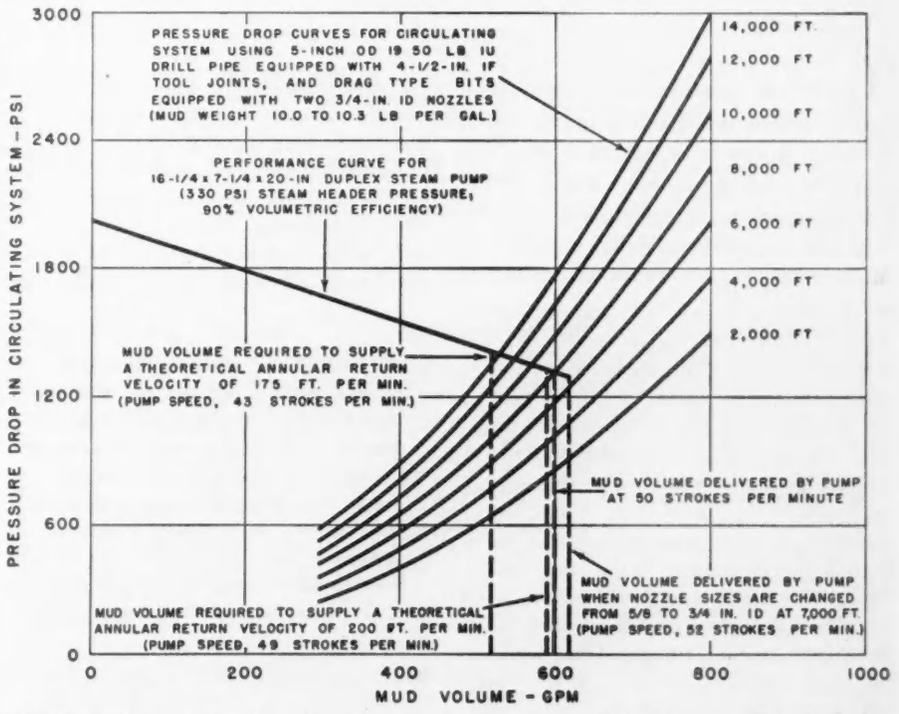

PRESSURE DROP CURVES FOR CIRCULATING SYSTEM USING 5-INCH OD 19.50 LB IU DRILL PIPE EQUIPPED WITH 4-1/2-IN. IF TOOL JOINTS, AND DRAG TYPE BITS EQUIPPED WITH TWO 3/4-IN. ID NOZZLES (MUD WEIGHT 10.0 TO 10.3 LB PER GAL.)
PERFORMANCE CURVE FOR 16-1/4 x 7-1/4 x 20-IN DUPLEX STEAM PUMP (330 PSI STEAM HEADER PRESSURE; 90% VOLUMETRIC EFFICIENCY)
14,000 FT.
12,000 FT
10,000 FT
8,000 FT
6,000 FT
4,000 FT
2,000 FT
MUD VOLUME REQUIRED TO SUPPLY A THEORETICAL ANNULAR RETURN VELOCITY OF 175 FT. PER MIN. (PUMP SPEED, 43 STROKES PER MIN.)
MUD VOLUME DELIVERED BY PUMP AT 50 STROKES PER MINUTE
MUD VOLUME DELIVERED BY PUMP WHEN NOZZLE SIZES ARE CHANGED FROM 5/8 TO 3/4 IN. ID AT 7,000 FT. (PUMP SPEED, 52 STROKES PER MIN.)
MUD VOLUME REQUIRED TO SUPPLY A THEORETICAL ANNULAR RETURN VELOCITY OF 200 FT. PER MIN. (PUMP SPEED, 49 STROKES PER MIN.)
PRESSURE DROP IN CIRCULATING SYSTEM — PSI
3000
2400
1800
1200
600
0
0
200
400
600
800
1000
MUD VOLUME - GPM

FIGURE 19. Method for determining size of nozzles to use in 9⅞-inch two-way drag type bits.

REFERENCES

[1] Bingham, T. F., Present Trend in Rotary Well Drilling and Completion, The Science of Petroleum, Volume 1, pages 406-429.

[2] Brantly, J. E. and Clayton, Edgar H., A Preliminary Evaluation of Factors Controlling Rate of Penetration in Rotary Drilling, Mid-Year Meeting of American Petroleum Institute, New Orleans, Louisiana, May 17, 1939.

[3] The Oil and Gas Journal, Vol. 45, No. 42, pages 147-149, February 22, 1947.

[4] Pigott, R. J. S., Mud Flow in Drilling Mud, Eleventh Mid-Year Meeting of the American Petroleum Institute, May 21, 1941.

[5] Warren, J. E., and Schabarum, B. R., Rate of Penetration in Hard Formation Drilling, Mid Continent District, American Petroleum Institute, Oklahoma City, Oklahoma, June 6-7, 1946.

[6] Johnston, David, Hard Rock Drilling in the Permian Basin, Southwestern District, American Petroleum Institute, Fort Worth, Texas, March 27-28, 1947.

[7] Rebinder, P. A., and Kalinovskaya, N. A. Reducing the Hardness of Rock Strata, Russ. 45: 576.

[8] Denisov, A. S., Hardness Reducers in Drilling, Razy, Nedr. No. 10:49-53, October, 1938.

[9] Aksil'rud, S. B., Use of Softeners in Drilling, Razvedka Nedr. No. 6:34-9, March, 1937.

Compounded Power Pumps

DRILL TO 10,000 FEET

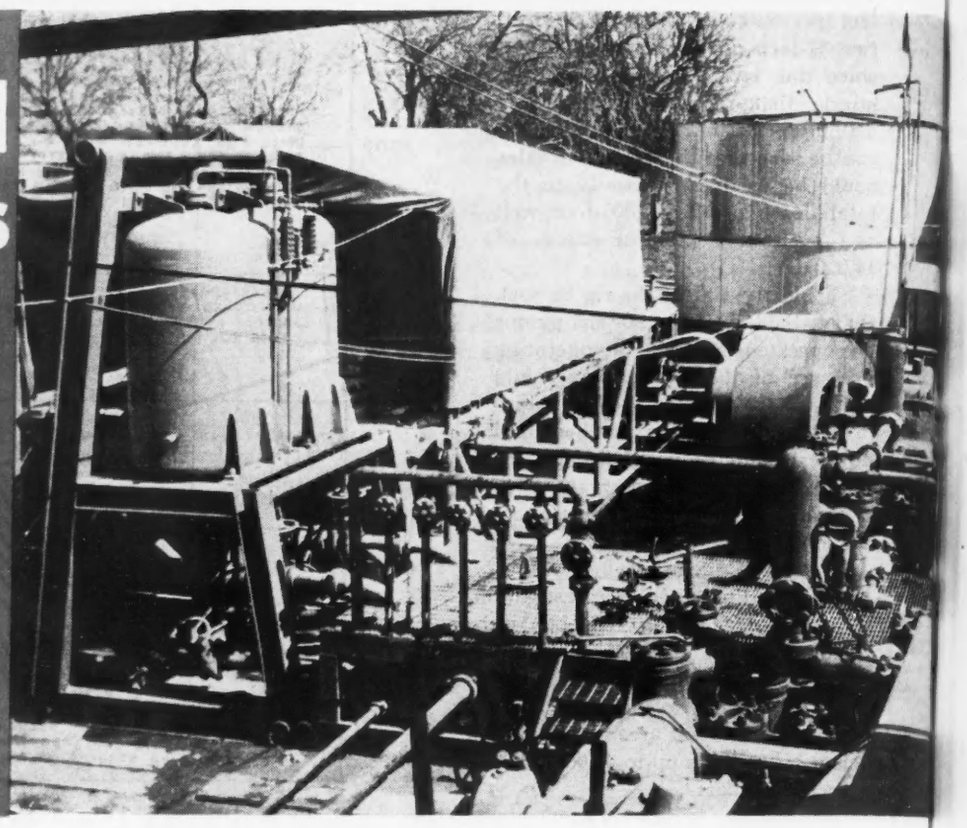


FIGURE 1. Field installation with pumps arranged for series operation.

THE first practical and continuous use of compounded power pumps in a drilling program is reported by The National Supply Company and Superior Oil Company after application in drilling two 10,000-foot wells recently in Matagorda County, Texas. Two pumps were used: one for the high pressure, driven from the rig, and one for the low pressure side, independently mounted as shown in Figure 1. These pumps have a 7¾-inch bore and 18-inch stroke, each rated at 385 horsepower output.

This advance in pump compounding methods opens new fields for power pump operation. Past inability to compound power pumps practicably in the field has been a serious handicap in developing higher power drilling rigs. Solution of other rig problems has emphasized the need for solving the pump problem. The principal application will be on deep wells, which require high pressures and greatly increased hydraulic horsepowers. Compounding also removes the limitations of internal combustion engines for the largest drilling rigs.

The advantages of compounding power slush pumps include:

1. Ability to utilize two or more smaller pumps that are more easily transported than a single large pump.

2. Flexibility in mud circulation. Pumps can be paralleled at the top of the hole, giving large volume at low pressure, or operated in series at greater depths to develope high pressure with reduced volume.

3. Ability to produce high fluid pressures with minimum wear on valves and pistons by dividing pressure load between pumps.

DIFFICULTY of compounding power pumps without alternately starving and crowding the high-pressure unit has led to the use of single high-duty pumps with frequent liner changes to meet increasing pressure demands. This article describes a method whereby two power pumps were satisfactorily compounded for working pressures in the 2000-pound range.

4. Better distribution of load among the several engines on a rig.

5. Fewer fluid cylinder liner changes.

Although the need for compounding was not critical on the Superior wells, it reduced drilling time and extended bit life as a result of the greater volumes obtained by increased pressure. Compounding equipment required no time for maintenance by either operator or manufacturer of the equipment. No air was added during the entire drilling operation. Any tendency toward air absorption probably was offset by entrained air in the mud. It was interesting to note also that the series operation of these two power pumps was satisfactory from the standpoint of minimum fluctuations in pressure and smooth pump performance.

In view of many past attempts to compound pumps, the real contribution of this development is believed to be the more thorough analysis of power pump operation, using laboratory facilities, and the bringing of series operation through the last few, most important steps from the experimental stage to full practical realization.

Series Operation

Series operation was accomplished by means of the two atmospheric air chambers that are shown in Figure 1 and by using fluid drives. The air chambers have an approximate capacity of 43 cubic feet and were designed to withstand 2500 pounds per square inch. pressure. One chamber was located between the high and low pressure pumps to compensate for the cyclic volumetric difference between the two pumps. The second chamber was placed in the discharge side of the high pressure pump,

as shown in Figure 2, to lessen pressure fluctuations.

An air chamber of adequate size on a single pump will transform the variable discharge into a practically constant flow by absorbing fluid when the discharge rate is high and discharging fluid when the rate is low.

Plotted data indicated that the function of the air chamber between the compounded pumps is to make the discharge rate of the low pressure pump conform to the variable suction requirements of the high pressure pump.

The chambers varied slightly from conventional design. The entire pump output passed through an enlarged tubular section. The fluid velocities and inertias were thus reduced enough to enable the chamber to absorb instantaneous surges. As a secondary consideration, the enlarged section was arranged to trap entrained air.

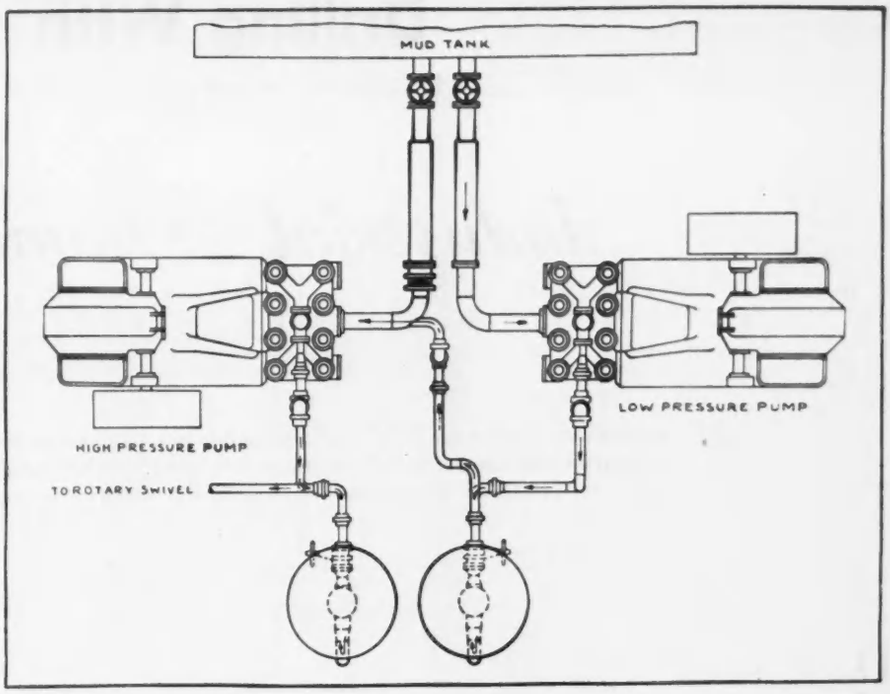
Fluid Drives

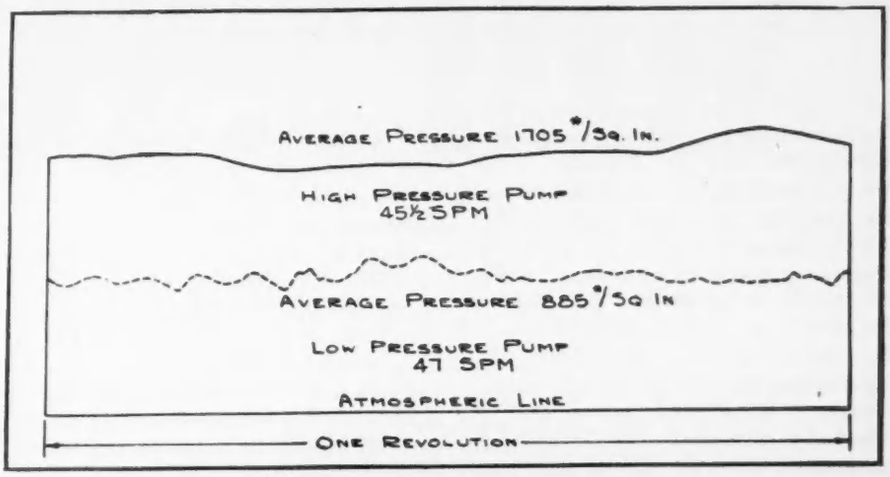
Fluid drives gave exceptional flexibility of operation, contributing greatly to distribution of load between pumps, to starting and stopping them, and to running a single pump at reduced speeds.

Series operation was quite simple and required little change in procedure. The low pressure pump had to be started first; then the drive clutch was engaged and the engine throttle advanced. The air chamber permitted the same operator to engage the clutch on the high pressure pump drive before the full load came onto the low pressure pump. The two pumps then operated in unison and attained maximum speed for a given throttle setting.

Flow of mud from the chamber on the high pressure side was exceptionally even, as shown in Figure 3. The even distribution of load is also illustrated. Circulation was 625 gallons per minutes through 9000 feet of 4½-inch internal flush drill pipe in a 9⅞-inch hole with a return velocity of 3.30 feet per second in the annulus.

Pressures as great as 2200 psi were attained during the latter stages of drilling to break circulation, and some drilling was done at 2000 psi. The circulating pressure was maintained between 1700 and 1800 psi for continuous drilling at the greater depths by adjusting the scoops in the hydraulic couplings so that the engines operated at full throttle.





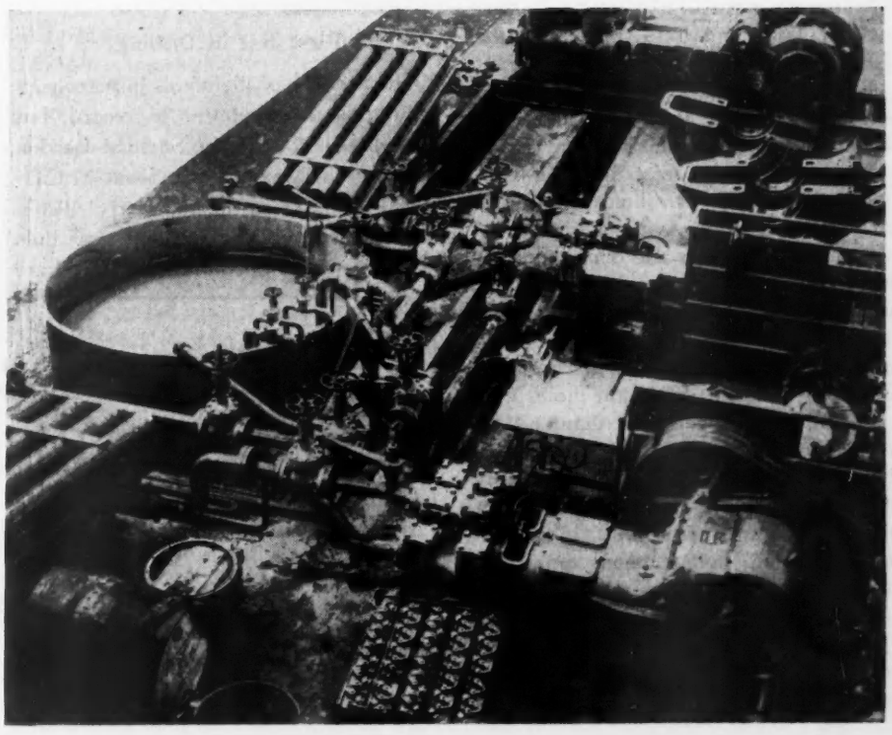


FIGURE 2 (top). Manifold arrangement for series operation.

FIGURE 3 (center). Pressure card with pumps operating in series with air chambers at 9000 feet.

FIGURE 4 (below). Laboratory test arrangement of two 5 x 10 duplex double-acting pumps.

Drilling With

DESIGN OF diamond-set coring and drilling bits has advanced to the point where specific formations and zones may be penetrated and cored with bits adapted to conditions. The author discusses bit design and illustrates with results from widely varying areas.

By KARL J. KLAPKA,
Engineer, Wheel Trueing Company, Detroit

DIAMONDS occur in four different forms, which vary in molecular and crystalline structure. These are bortz, congos, carbonados, and ballas. Stones used industrially are those which are not suitable for cutting into gem stones. The percentage of gem stones varies extensively in different deposits. South Africa, the Gold Coast and Sierra Leone run high percentages of cuttable stones; Brazil's average is slightly lower, and other regions produce a preponderance of industrials. The Belgian Congo produces a very small percentage of cuttable material, while ballas and carbonados are not suited at all. Carbonados are found only in one part of Brazil and are generally known as black diamonds.

Diamonds were first used for drilling rock in 1862, and until 1926 only the black diamonds were used.

The first mechanical setting of bits was perfected in 1930, and by 1938 almost all setting was done in this way. However, this technique is still being constantly improved. Continual research is carried on to improve the abrasion resistant characteristics and diamond holding properties of the matrix metal. New methods of fastening the diamond studded crown to the blank safeguard against the chance of any part of the assembly shearing off in the hole.

In the mining field the diamond bit has achieved considerable acclaim for its durability and ability to cut hole rapidly at a considerable saving in cost per foot of hole cut. In one locality, in a relatively soft and homogeneous limestone, record footages as high as 12,000 and 14,000 feet have been obtained with 1¼-inch diamond bits. The general average in this area, however, runs approximately 7000 feet. The structural formation in other areas does not allow the diamond bit to work at its fullest efficiency due to fractured, brittle, or abrasive characteristics. Operating technique is often responsible for damage to the bits and for these reasons footages are not as high. However, where these conditions are encountered, the relative cost of conventional types of drilling is higher.

The use of bortz or industrial diamonds in the petroleum industry represents an important advance in coring and drilling technique. Diamond bits have been used successfully in the U. S., Canada, and South America, not only to achieve almost a 100 percent core recovery, but also to cut hole at a substantial saving in time and money.

First Use in Drilling

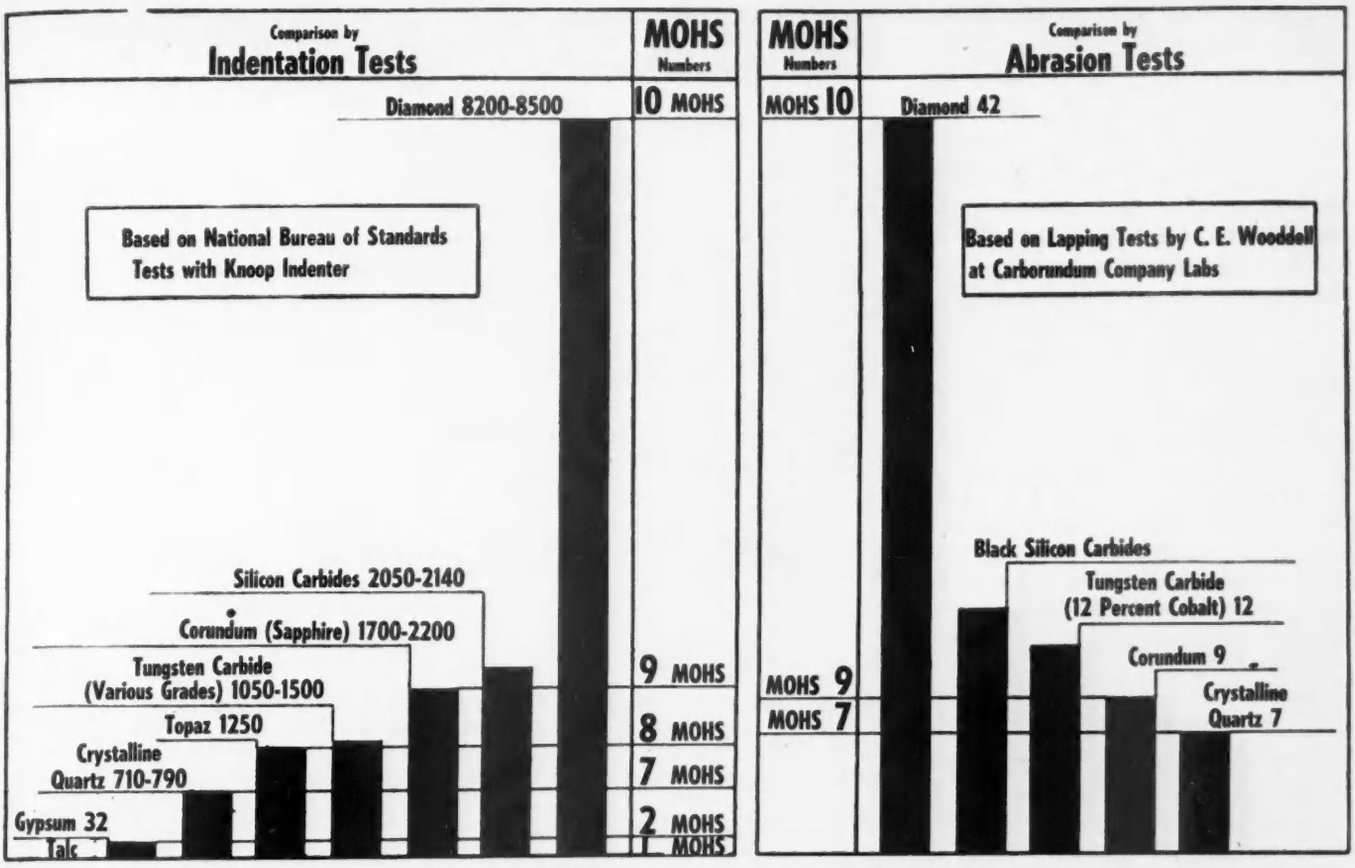
The first use of diamonds in petroleum drilling is not a matter of record, but is credited either to the Sheldon-Burdon Company in Mexico or to Stone in California or Mexico in the early 1920's. Since the fishtail bits, the only type then existent, would not hold up in the hard formations encountered, diamonds were handset and peened into holes drilled into the edges of the fishtail bit blades. These stones were relatively large and expensive. In addition, they were not successful in that they fell out and were lost due to the poor handsetting methods used.

With the advent of the rotary rock or core bit, which enabled the industry to penetrate hard formations at a reasonable cost, the use of diamonds was discontinued. Some limited experimentation with smaller mining size bits and core barrels was carried on in Canada, by rat-holing ahead of the conventional rock bit. This method enabled the geologists to obtain essential information, but it proved to be excessively expensive in the majority of cases.

In 1943, the Shell Oil Company in California began testing large size solid diamond bits (Figures 2, 3, 4). Although little hole was made, the results were encouraging. At that time it was realized that with modifications in design a successful diamond bit could possibly be manufactured for oil well drilling. The main weakness

About the Author

KARL J. KLAPKA graduated from the University of Wisconsin in 1940 with a B.Sc. degree in mining and metallurgy. Prior to and after the war he was a petroleum engineer in the drilling and production department of the Shell Oil Company. He has been interested in diamond drilling possibilities in the oil field since the early development of this technique and at present is an engineer with the Diamond Drilling Division of the Wheel Trueing Company at Detroit, Mich.



Courtesy of the Industrial Diamond Association

FIGURE 1. Comparisons of arbitrary numbers of the MOHS system (year, 1818) with degrees of hardness determined by modern scientific methods. On this chart, the MOHS numerotation is compared with the actual results of tests for hardness by abrasion and by indentation. The latter are based on tests made and reported by the National Bureau of Standards (Knoop, Peters, and Emerson, 1939). The abrasion test figures are based on report by Charles E. Wooddell, director of research and development, Carborundum Company, 1935, and on correspondence between I.D.A. and Wooddell, June, 1947, and convey a particular indication of the toughness of diamond.

in the solid, or full hole, bit has been at the geometric center. Diamond core bits perform best when the core diameter is at a maximum, because the difference in lineal feet traveled per unit of time by the outside diameter and the inside diameter is small enough to insure peak diamond performance. In the solid bit, the center diamonds practically stand still, while the diamonds on the O.D. are traveling at the correct cutting speed. Consequently, the outside of the bit cuts itself free, imposing an overload on the center diamonds which crushes and destroys the center of the bit.

Early successful diamond coring or drilling operations were carried out in the West Edmond field and the Weber sand at Rangely, Colo., for the Stanolind Oil & Gas Company in 1946. The 400 to 500-foot Weber sand section was cored in approximately one-fourth the time required for conventional rock bit drilling. It was at this time that it first became apparent that diamond coring operations were useful, not only for high core recoveries, but also for reducing the cost per foot and number of rig days to complete a well in the thick Weber sand pay zone.

Since that time, diamond coring operations have expanded at a tremendous rate as operators became aware of the fact that this new tool not only obtained almost a 100 percent core recovery but in some cases also decreased drilling costs. Many operators throughout the U. S. soon began diamond coring operations. These operations rapidly expanded to the Turner Valley and Leduc fields in Alberta, Canada. At this time, the diamond bit is being used successfully in South America in hard sand sections, not only as a coring device but again, as at Rangely, as a means for reducing drilling costs. Diamond coring has been carried on in wells ranging in depth from 1500 feet to almost 17,000 feet in Oklahoma.

Typical Advantage

As a typical case, one advantage of diamond bits can be cited from the experience of an operator in Wyoming. At a depth of 13,000 feet, a hard siliceous sandstone was encountered. Only one or two feet could be cut with each conventional bit, necessitating a considerable number of trips and bits. The operator, therefore, decided to try diamond coring methods. This section, approximately 350 feet thick, was cored at an average rate of penetration of 15 minutes per foot, and with core runs averaging approximately 20 feet. Only three diamond bits were required for this operation.

Recently in Oklahoma a hard, solid quartzitic fine-grained sandstone was encountered at 16,000 feet, about 200 feet above the prospective pay. Seven conventional bits were used and cut only one foot. It was then decided to attempt to core the interval with diamond bits and during the first week a total of 250 feet of core was cut in this formation.

At the present time, diamond core bits are being manufactured for petroleum drilling[1] in sizes varying from those which cut a 4 13/16-inch hole and a 2¼-inch core to the 8¾-inch bit which cuts a 4⅞-inch core.

Some examples are: A run of 746 feet with one diamond bit in Oklahoma,[2] which included 73 feet of chert; a run of 586 feet with one diamond bit in Michigan, which included limestone, shale, dolomite, anhydrite, and some chert; a run of over 500 feet with one diamond bit in the Madison limestone and dolomite at Elk Basin, Wyo.; and a run of over 725 feet in East Texas in

the Travis Peak and Rodessa formations with two 8¾-inch bits.

The penetration speed of these bits normally varies from 20 minutes per foot in hard siliceous shales to as low as 30 seconds per foot in less consolidated sandstones. However, the general average approximates eight to ten minutes per foot. In addition to changes of formation, other factors control the rate of penetration to a considerable degree. Highly viscous drilling fluids, incorrect fluid volume through the bit, poor control of the drilling weight on the bit, instability of the core barrel and improper rotary revolutions are a few of the contributing factors to a poor rate of penetration. These must be varied in different fields and the operator must be trained to understand what is required to insure the conditions necessary in obtaining peak diamond performance at all times.

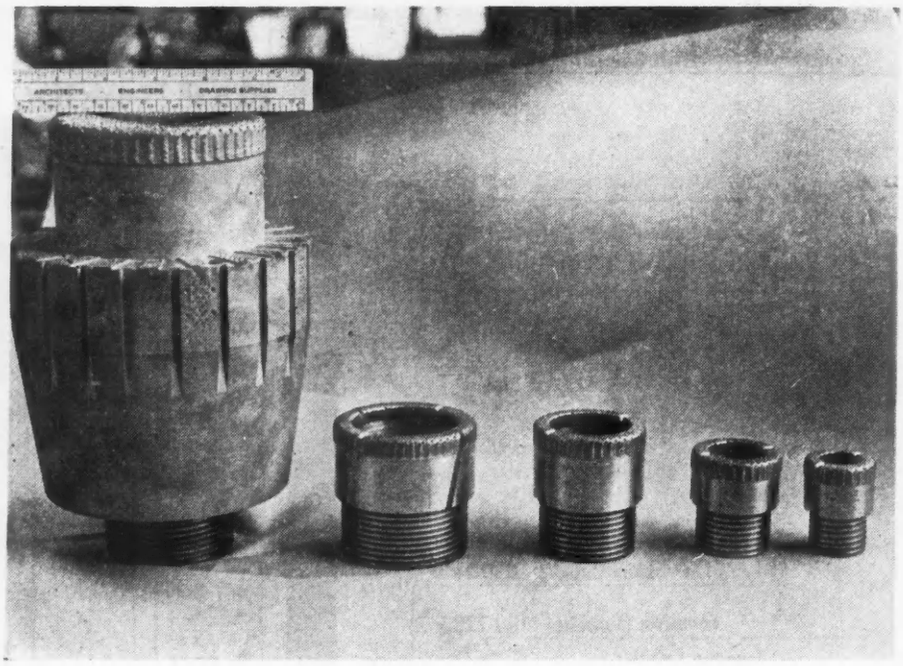


FIGURE 2. One of the original solid diamond bits tried in the oil fields as compared to standard mining bits.

Saving at Rangely

At Rangely, Colo., the normal 400 to 500-foot Weber sand section can be cored in a matter of about six days at a total cost of approximately $5.50 per foot. The saving to the operators is quite apparent when the former cost for conventional coring (approximately $70.00 per foot in 47 days) and conventional drilling (approximately $35.00 per foot in 25 days) is taken into consideration.

FIGURE 3. Solid center pilot bit prior to being mounted in full O.D. master bit.

The Bromide sand, limestone and shale section in the East Lindsay field in Oklahoma presents a somewhat similar picture in that operators find about a 40 percent saving in drilling costs and a saving of 13 or 14 drilling days.

The Traverse and Dundee sections have been cored in Michigan with a resultant saving of 50 percent in cost per foot over that of conventional drilling. In a very dense anhydrite section, the drilling time has been cut in half by the use of diamond core heads, with bit footages averaging 300 feet or better, and with approximately a 100 percent core recovery.

The Devonian chert section, in the Block 31 field in Crane County, West Texas, was cored successfully with almost a 100 percent core recovery at drilling costs almost comparable to those achieved in normal drilling. As the operator became more familiar with diamond coring operations the cost per foot was decreased. An accurate estimate of the time required to drill the chert section in each well could hardly be made since the structure varied extensively throughout the field.

In this case, it was apparent that the time required to complete the well with diamond core bits was, or could have been, less than normally required using conventional drilling methods.

At Elk Basin, Wyo., the Tensleep sand formation is being cored with 8¾-inch diamond bits cutting a 4⅞-inch core. Subsequently, 7-inch casing is set at the top of the Madison Limestone and the entire 700 to 800-foot Madison section is cored with 6⅛-inch diamond bits. This operation is not only obtaining approximately 100 percent core recovery, but is being carried out at a saving in drilling costs. In addition to this operation, those wells situated favorably on structure and at present producing from the Tensleep, are being deepened through the Madison by diamond coring operations prior to a dual completion.

Reverse Circulation Methods

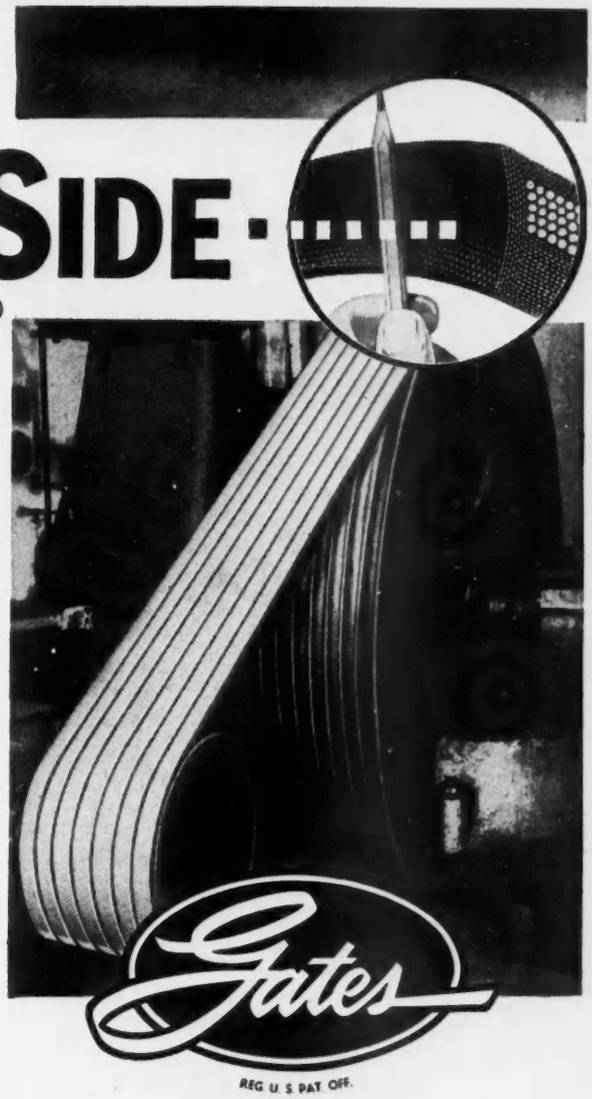
Coring by reverse circulation methods has met with varied success. Stanolind Oil & Gas Company cored three wells

FIGURE 4. Entire solid bit assembly showing failure of pilot bit. This caused damage to the master bit as the pieces of the disintegrating pilot were washed toward the O.D.

Here is **WHY** *the*

CONCAVE SIDE-

(U. S. PATENT NO. 1813698)



The Mark of SPECIALIZED Research

SAVES You Many DOLLARS In V-BELT Costs!

Every time a V-Belt bends around its pulley, the *top* of the belt is under *tension* and grows *narrower*. The *body* of the belt is *compressed*—causing the *sides* to *bulge out!*

FIG. 1

Because of these stresses, any V-Belt built with straight sides is forced to assume, in the sheave groove, the shape shown in figure 1, on the left.

This forced bulging of a *straight-sided* V-Belt against the sheave groove walls naturally produces excessive wear along the *middle* of the belt's sides—as indicated by the arrows. Also, because the full side of the belt does not *uniformly* grip the pulley, there is a definite loss in drive efficiency.

Now see the difference when you bend the V-Belt that is built with the precisely engineered Concave Side (U. S. Patent No. 1813698)—the Gates Vulco Rope.

FIG. 2

As the Gates Vulco Rope bends, its Concave Side becomes straight (Figure 2). It exactly fits the sheave groove—and this gives you two very definite savings:—

(1) No out-bulge of the sides means uniform side-wall wear—*longer life!*

(2) *Full side-width* grip on the pulley carries heavier loads and sudden load increases without slippage—saving your belts and saving power too!

The Concave Side is MORE IMPORTANT NOW Than Ever Before!

Because the *sides* of a V-Belt are what actually *drive* the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley *directly* through the belt's sidewalls.

Now that Gates SPECIALIZED Research has made available to you *SUPER* Vulco Ropes —carrying fully 40% higher horsepower ratings —the life-prolonging Concave Side naturally delivers greater savings today than ever before.

4810

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

THE GATES RUBBER COMPANY
DENVER, U.S.A.
"The World's Largest Makers of V-Belts"

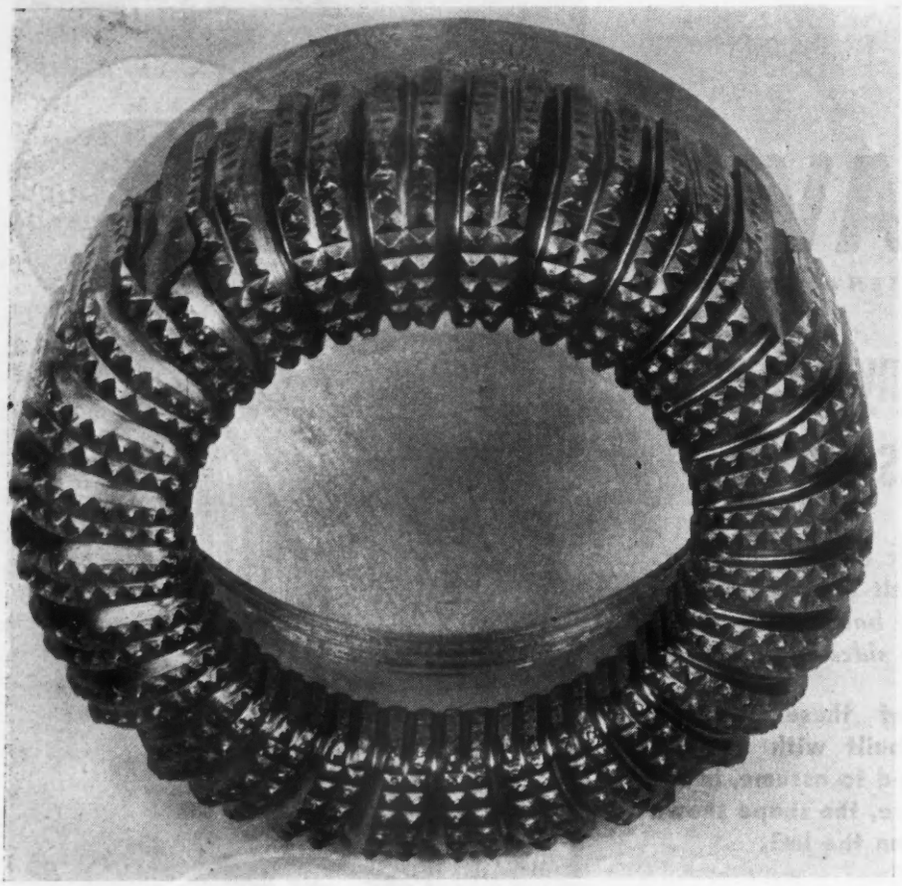


FIGURE 5. Special design for drilling soft, homogeneous, and non-fractured formations. Note large clearance for increased fluid volume and elimination of cuttings.

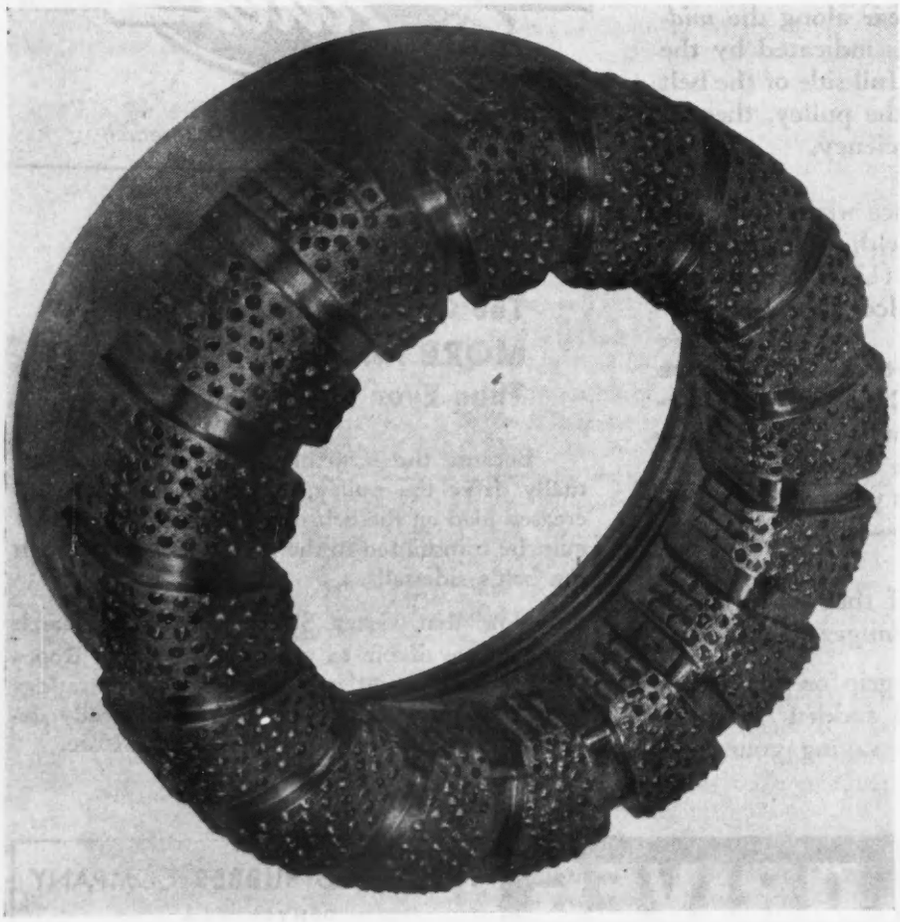


FIGURE 6. Standard general purpose bit where the formation types to be encountered are not definitely known.

by this means at Rangely, Colo., and several in West Texas.

The reverse circulation method has certain advantages over that of conventional coring, in that the basic necessity for trips is eliminated. Theoretically speaking, this is correct. However, the main difficulty encountered is wedging and blocking of core in the tubing as it is pumped to the surface. This necessitates reversing the flow of fluid to break the block, but where this does not prove effective a trip is necessary. As soon as some operator obtains a string of I.D. flush drill pipe whereby the larger size cores may be flushed to the surface, it is felt that an even more successful operation could be achieved.

In this type of operation, a core catcher is located in the bit to break off the core whenever a connection is made. The tubing string must be internally flush from this point to the core retriever located immediately below the kelly. The core retriever has a larger O.D. than the flush tubing and allows the fluid to bypass. Whenever a connection is made, the core retriever is pulled and emptied, the new joint is added, and the coring operation is then continued.

At Rangely, a 399-foot section of Weber sand was cored without taking the bit off bottom. Actual coring time was approximately three days, but, due to wedging in the tubing and time required for connections and emptying the retriever, the over-all time was four and one-half days. In West Texas, the results have been fairly satisfactory, but no exceptional footages have been cut prior to a required trip.

Reverse circulation coring has proven satisfactory only in areas where the formation is homogeneous and not fractured. Cores up to five feet in length have been recovered by this method.

Calculating Costs

In calculating diamond bit costs, it is essential to realize one important fact. The initial cost of the bit is much greater than that of the conventional types in use at present. However, with proper use and foresight to pull the bit prior to complete failure, a valuable salvage of the re-usable diamonds is realized. This salvage recovery, therefore, decreases the net cost of the bit. In various fields the bit cost per foot is being greatly reduced. Diamond bits have been averaging as low as $0.90 per foot cored in hard sandstones and siliceous shales and around $2.50 per foot in limestones or anhydrite. However, there are areas in which the conditions are such that the badly fractured and abrasive formation is equally hard on both

TRUCO STA
OIL FIELD ST

TRU O DIAMOND D

Irresistible Cutting Power

Truco Bits pe
tions and, the

These are

Write and re

of Truco Diam

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue
Detroit 6 • Michigan

WHEEL TRUEING TOOL CO. of CANADA, LTD.

575 Langlois Avenue
Windsor, Ont. • Canada

Truco Oil Field Products are

SERVICE, INC.

conventional bits and diamond heads, and the cost per foot for both is correspondingly increased.

Variety of Designs

It has long been realized that a variety of diamond bit designs will be required. Since the interval to be cored may comprise formations varying from soft gummy anhydrite to hard quartzitic sandstone or chert, the bits must be constructed to perform with maximum efficiency in the type penetrated. Therefore, bits are now being made which will cut the softer formations rapidly; others in which the diamonds will be better protected against anticipated abrasive action; and further design classifications are for use in formations which contain broken or fractured chert, wherein the diamonds might be sheared off by the broken fragments rolling under the bit. (Figs. 5, 6, 7.)

In addition to these varied formation designs, there has been demand that bits be designed to allow circulation of greater volumes of fluid. This has been accomplished through redesigning of the bit patterns and by extensive research on fluid flow through restricted areas. A further avenue of research has brought about the designing and manufacture of a relief valve constructed to allow a measured volume to pass over the bit and the balance to bypass it into the annulus above the core barrel. This project is still in the experimental stage.

As these design changes are made, it is at times necessary for the engineers in the field to adjust the operating technique accordingly. Supplementary drilling instructions are issued to comply with all modifications and, in addition, the bits are tagged in an effort to draw immediate attention to the change.

Not only have the bits been modified and improved, as the petroleum industry expanded this branch of drilling, but the core barrels used in conjunction with them have gone through an evolution of their own.

The original core barrel used with diamond core bits was of the double-wall type with a bearing-mounted inner barrel. The bearing was exposed to the flow of drilling fluid as it passed between the inner and outer barrels and down under the bit. In cases where the drilling fluid contained appreciable percentages of abrasive material, such as sand, the bearing had to be checked and frequently replaced. In addition, the core catcher was contained in the bottom of the outer barrel. This necessitated a large gap from the cutting face to the point where the core entered the barrel and allowed wedging or jamming of fractured core with subsequent core loss and breakdown of the I.D. on the bit. Also, if excessive volumes of fluid were being circulated, there was a possibility of forcing the core catcher down into the taper and subsequently jamming it against the core, thereby rapidly wearing the catcher out. In cases such as this, upon failure of the core catcher, the pieces were forced down under the bit by the excessive fluid velocity, causing bit failure and loss of core.

Core Barrel Modifications

The present core barrel has been modified so as to overcome these problems and perform with far greater efficiency. The bearings are now protected in a sealed grease container, thereby eliminating the time and labor of changing. The core catcher has been incorporated in a sleeve at the bottom of the inner barrel, thereby allowing it to extend to within a couple of inches of the face of the formation. In this manner, additional volumes of fluid may be circulated without affecting the core catcher. These improvements have aided diamond coring considerably, especially where fractured and abrasive formations are encountered.

Core barrels are specially designed to meet all the conditions required for proper operation of the diamond core heads. The use of a special barrel for diamond coring gives rise to the question of how this expenditure shall be debited against cost per foot of core cut. It is now becoming apparent that a core barrel, if put to normal use under the proper techniques of operation, will last for 5000 to 8000 feet of hole and may be pro-rated on such a basis.

Nearly 100 percent core recovery is now obtainable in most cases, and cores are in excellent condition for laboratory analysis or for picking formation contacts. Where the percussive action of the roller bit tends to grind up softer or fractured cores and, due to the flushing action, causes excessive core loss in some cases, the diamond bit recovers the very porous, vugular, and unconsolidated sections of the pay formation allowing a more thorough reservoir analysis.

These core recoveries and the subsequent determination of productive porosity, permeability, connate water, and fluid saturation, have enabled geologists and engineers to complete wells, and to calculate reservoir conditions more effectively. Moreover, in ever increasing areas diamond coring is showing economy as a practical drilling method, and the cores recovered are merely an added advantage.

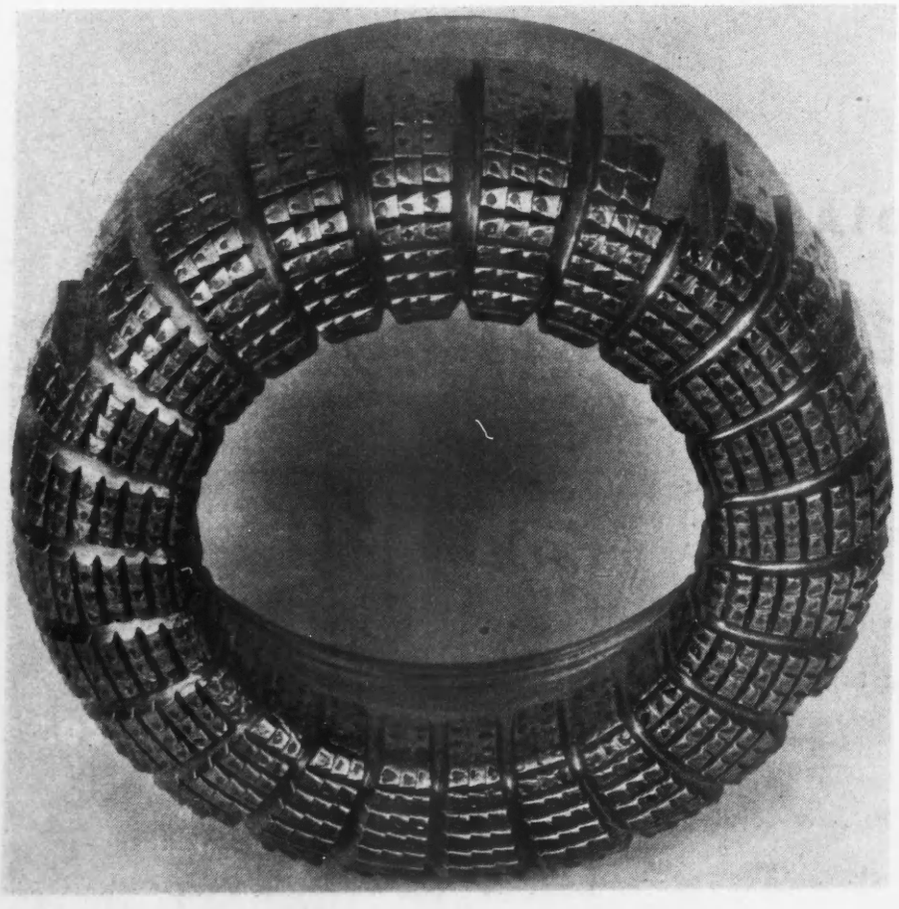


FIGURE 7. Special design for fractured or cherty conditions which maintains a metered rate of penetration.

REFERENCES

[1] Deely, Carrol, Source and Use of Diamonds in Oil & Gas Well Coring. WORLD OIL, vol. 127, No. 6, p. 87. Oct. 1947.

[2] Swesnik, R. M., Diamond Coring an Oklahoma Well, WORLD OIL, vol. 128, No. 3, p. 92. July, 1948.

for WORK-OVER and DRILLING

Model L844-52" DRAW-WORKS

This compact streamlined unit is built for drilling 4,000′ to 6,000′ holes. It will handle work-over jobs to 10,000′. Requires only one truck or float to move. Power and draw-works are one self contained unit.

NEW—**AIR CONTROLS, convenient, easy to operate, fast acting finger tip control of all clutches. Extremely simple design, practically eliminates maintenance.**

NEW—**BRAKES, on this unit are 52″ dia. x 10″ w. Each brake has two 5″ equalized bands and each brake is equalized, Cooper, patented, circulating air cooled heat dissipation design.**

NEW—**CLUTCHES, air actuated positive dental type. Rigidly constructed and Timken bearing mounted, practically free of wearing parts—no throw-out yokes.**

NEW—**DRUM DRIVES, arranged so that no chains are idling during any operation. Drum is free rolling, with 8 speeds forward, one reverse. Drum is driven from a rugged specially built FOUR speed transmission. CAPACITY is 13,000′ of ¾″ line.**

- **This unit is powered with an Allis-Chalmers Model L844 six cylinder tractor type engine, developing 590 ft. lbs. torque. Runs on butane, natural gas, gasoline or low grade fuels.**

- **This unit can be equipped with Rotary Drive, Catheads, Cross-arm Spudder, Mast and TWO or THREE drums.**

There are several smaller Cooper WORK-OVER Units. May we send complete specifications?

FRED E. Cooper, Inc. TULSA, OKLA.

Phone 5-7191 P. O BOX 1890

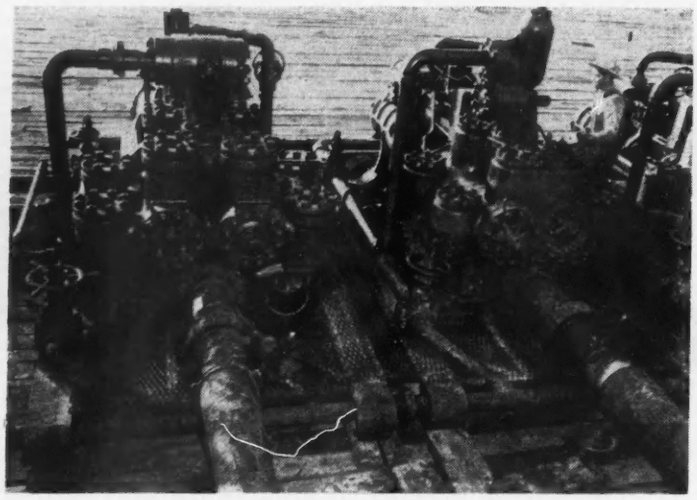
Branches — HOUSTON — Ph. Fairfax 4619 LYNWOOD, Los Angeles — Ph. Newmark 24747

DRILLING HINTS

How to do it!

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Unitize Heavy-Duty Mud Pumps for Quick, Easy Moving



Considerable effort has been concentrated in the past few years toward unitizing drilling rig equipment so it may be dismantled, moved, and reassembled with a minimum of lost time. Because of their weight and bulk, heavy-duty mud pumps are normally mounted one to a skid and form a problem in themselves when unitization is considered. One plan which will do much toward minimizing setting up and tearing down time requires that the pumps, be there two or three, be set side by side.

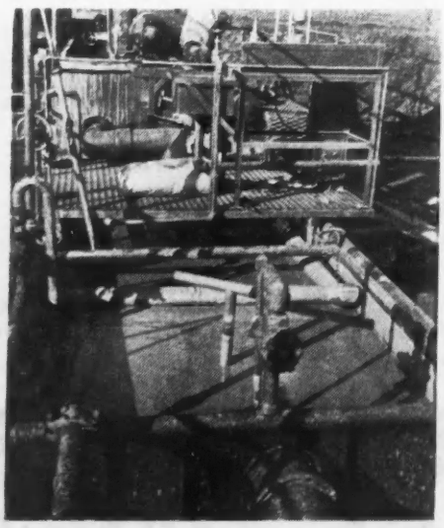
Steam supply and steam exhaust lines have been welded in the skid to become a part of it. Exposed ends of these lines are fitted with couplings with sufficient clearance between each skid base that the lines can be joined when the skids are in their proper position. Also included in the skid is the mud line. This line, three inches in size, forms one end cross brace for the skid, and when connected to the adjacent pump skid, forms a mud line extending the entire length of the pump battery. It is also connected by means of pipe couplings.

One interesting feature of the unitized pump battery is the piping design for compounding the pumps or for operating them in parallel. A tee in the mud pump discharge line ties into the mud line incorporated with the skid. A lateral pipe connection is welded to each suction line for compounding. Mud discharged from one mud pump into the compounding line may be picked up in the suction of an adjacent pump. Normally, the lateral line on the pump suction is closed, permitting the pump to take its suction directly from the slush pit. The lines are so arranged to require a minimum length and fewer fittings.

HOW TO—Save Time in Setting Up Shale Shaker Skid in Mud Tank

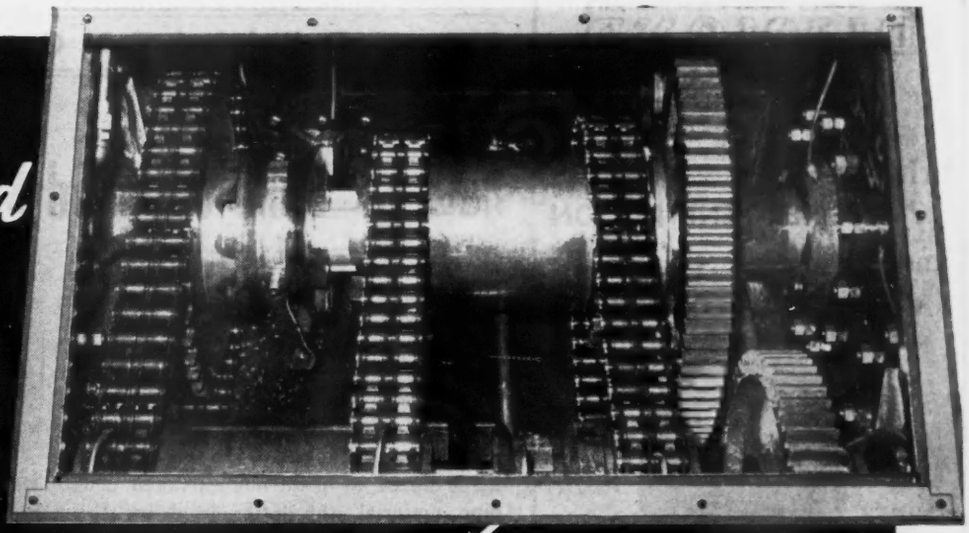
Much time and effort have been saved by a simple idea that provides for setting the shale shaker skid into one of the mud tanks. The shale shaker, chemical treating tanks, and mud testing equipment are mounted on one skid made from three-inch pipe. Size of the skid is such that it just fits inside the receiving mud tank.

A bench or support has been welded inside the mud tank to receive the shale shaker skid. Height of the support is such that when the skid is in position, the expanded metal walkways are on the same level with the platform around the shale shaker and mud testing rack. The shale shaker is also at a convenient height above the mud tank since the cuttings go over the side of the tank and the mud into the tank.

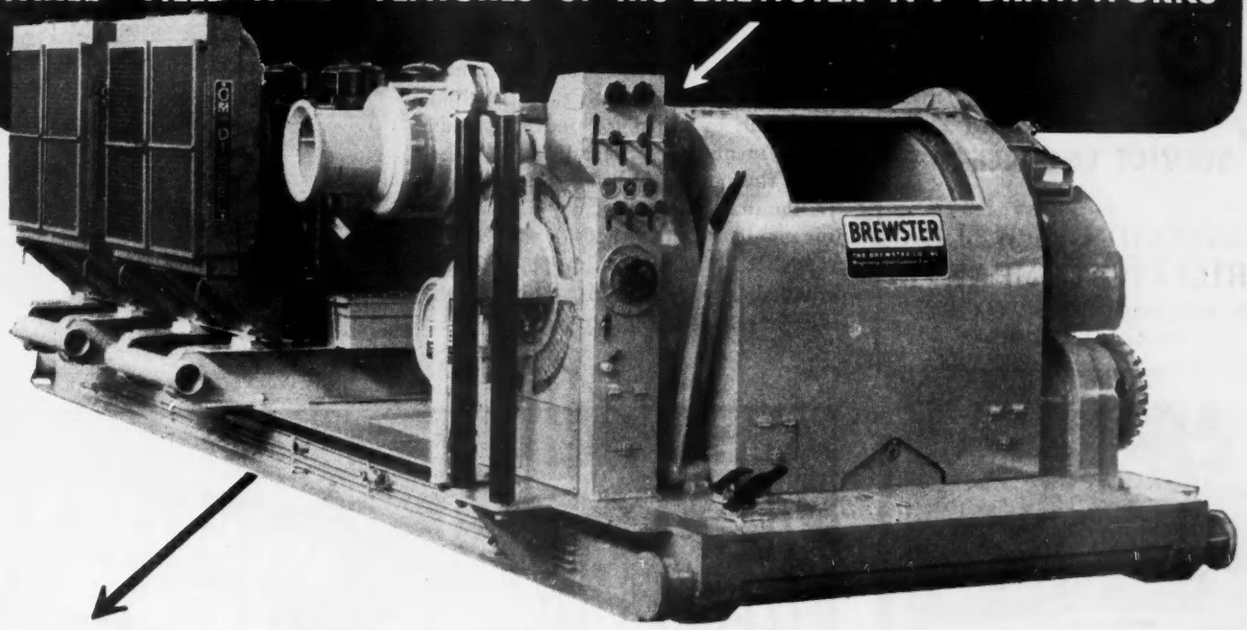


When the rig is to be dismantled for a move, only the piping connections to the shale shaker and chemical tanks need be disconnected. The skid is lifted from the tank and is ready for loading onto a truck. At the new location, it is a simple matter to set the shale shaker skid back in place and make up the connections. During short moves, it is not even necessary to remove this skid since all equipment can be moved with the mud tanks which are mounted on skids. Considerable convenience is provided by this unitized tank and shaker since the derrickman who cares for the mud is able to observe the flow of mud from the shaker into the receiving pit from one place, as well as adjust the flow of chemical additives.

Compact, Streamlined and Silverlink Roller Chained . .



THREE "FIELD-WISE" FEATURES of the BREWSTER N-7 DRAWWORKS



Brewster built this N-7 drawworks around features they knew operators wanted . . . a compact, streamlined rig with smooth operation and plenty of reserve power.

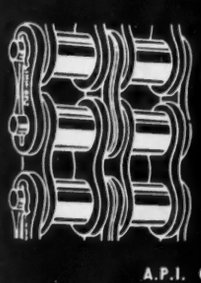
Then Brewster chained this drawworks completely with Link-Belt Silverlink Roller Chain . . . favorite of manufacturers and operators alike.

Power in the N-7 is delivered through an oil bath compound and 4-speed 500 H.P. transmission giving 8 line speeds . . . all chained with Link-Belt Silverlink Roller Chain.

Great strength, light weight, flexibility and ability to withstand sudden shocks has made Silverlink top performer among roller chains. It's the result of more than 70 years of chain improvements.

LINK-BELT COMPANY

Indianapolis 6, Dallas 1, Houston 2, Los Angeles 33, Kansas City 6, Mo., New York 7, Toronto 8. 11,117

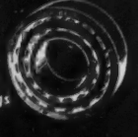


Silverlink Roller Chain

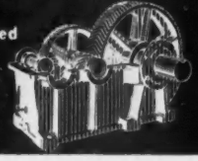
A.P.I. Chain

LINK-BELT

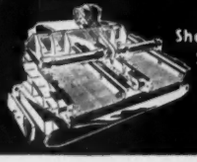
Serves the Oil Industry



Roller Bearings

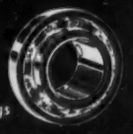


Enclosed Gear Drives



Shale Shakers

Silverstreak Silent Chain Drives



Ball Bearings

DIAMOND CORING

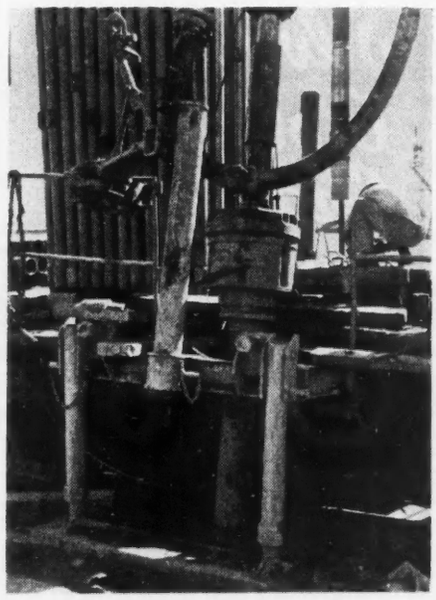
brings...
✓SPEEDIER PENETRATION
and...
✓GREATER RECOVERIES

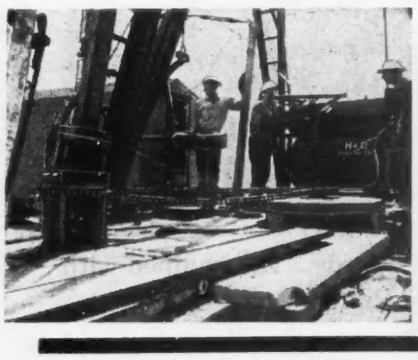
✓DIAMOND CORE BITS ...for sale
✓SPECIAL CORE BARRELS for rent or sale
✓SERVICE ENGINEERS

DIAMOND OIL WELL DRILLING COMPANY
815 MIDLAND TOWER PH. 2710
MIDLAND, TEXAS

HOW TO—Build Outboard Support for Rat Hole

The problem of finding floor space on the typical portable drilling rig used today is a critical one. One operator solved part of the problem by designing an outboard structure which positions and carries the weight of the rat hole pipe. The rectangular framework is made up of I-beam and salvaged drill pipe material, the latter used for the two supporting legs. It is so designed as to permit rapid dismantling when the rig is to be moved. Heavy steel pins lock the legs in position once the unit is set up, and screw-type telescoping legs at the bottom permit rapid levelling of the unit to adjust for uneven ground. Heavy turnbuckles extending down between the outer edge of the framework and the main support of the rig hold the unit rigidly against the side of the rig. A socket for the backup post also is provided, a pin being used to lock the post in position once it is set up.

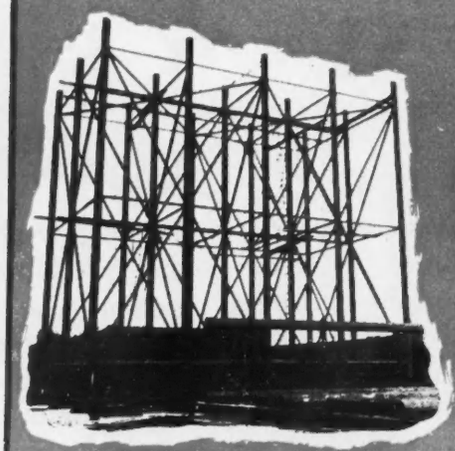




"Pampco"
RAT HOLE DIGGER

- Built to fit usual standard kelley bushings.
- Take-off power to operate rathole digger from rotary table.
- Saves time and hazard of moving rotary table from normal position.
- Bolts to standard rig base and operates on series of roller and ball-bearings.

Contact
PAMPA MACHINE CO.
120 S. HOBART PAMPA, TEXAS



AVONDALE'S ANSWER
TO YOUR OFFSHORE
DRILLING PROBLEMS!

AVONDALE has fabricated these pipe jackets for J. Ray McDermott & Co., Inc., to build platforms for drilling oil wells in the Gulf. For dependable marine equipment construction... Consult

AVONDALE MARINE WAYS, Inc.
River Front: New Orleans District
Mailing Address: Westwego, La.
Main Plant: Avondale, La.
Quick Repair Plant: Harvey, La.

A Background of PERFORMANCE

PREFORMED
and
NON-PREFORMED

When you specify "HERCULES" (Red-Strand) Wire Rope, you select a product that has proved its dependability—time after time—by the acid test of actual service.

Such a long and *consistent* record of performance is not a matter of chance; instead, it is the result of many definite factors that have always governed the design and manufacture of "HERCULES" (Red-Strand) Wire Rope.

For wire rope qualified to withstand the stresses and strains encountered on tough jobs...use "HERCULES" and benefit by its time and money saving ability.

"HERCULES"®
(RED STRAND)
the DEPENDABLE
WIRE ROPE
for any TOUGH JOB
® REG. U.S. PAT. OFF.

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

ESTABLISHED 1857

5909 KENNERLY AVENUE • ST. LOUIS 12, MISSOURI

NEW YORK 6 • CHICAGO 7 • HOUSTON 3 • DENVER 2
LOS ANGELES 21 • SAN FRANCISCO 7 • PORTLAND 9 • SEATTLE 4

Here are Hooks that hoist your Profits!

Clevis Hoist Hook Is Quickly Attached . . . Changed . . . Saves Time and Labor. Slip the bolt through the clevis, spin the nut, spread the cotter and this heat-treated hook's ready and safe for your toughest jobs. No welding, no spelter, no connecting fittings required. Send for Laughlin's famous data book of industrial fittings... Catalog No. 140.

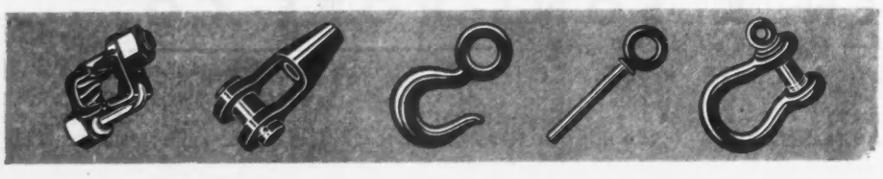
THE THOMAS LAUGHLIN CO., DEPT. 23, PORTLAND 6, MAINE.

Laughlin Safety Hook . . . "The Latch Locks The Load" . . . adds a big safety factor to every lift. Sturdy latch, stainless steel spring. For every industrial application.

Laughlin Replacement Swivel Hook Assembly with Safety Latch. Bolts on and off . . . no machining . . . no threading. For hoists, cranes, lashing operations. One-ton and half-ton sizes.

LAUGHLIN

THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS

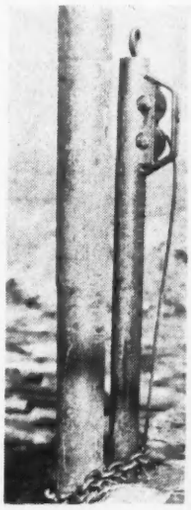


DRILLING HINTS

HOW TO—

Guide Tong Return Line

The amount of time saved in making up drill pipe joints or casing is probably directly proportionate to the efficiency of the tools used in this operation. Automatic catheads have been developed to a point where little if any additional time can be cut from their action in tightening a joint of casing or drill pipe. However, their quick action depends upon the readiness of the tongs which must be extended after each makeup pull of the tong line.



If the tong return line responds quickly, considerable time will be saved in this tightening operation. Many ideas have been incorporated in one particular tong return line hookup which has functioned satisfactorily and has resulted in a saving of time in making up a joint. The force which draws the tong handle back into position for another "bite" on the tool joint or casing is a vertically-supported weight. This weight is sufficient for a quick pull back of the tongs, making it only necessary for the tong operator to hold the jaws firmly against the pipe. The weight is encased in a section of four-inch pipe supported vertically to the derrick edge and extending about 30 inches above floor level.

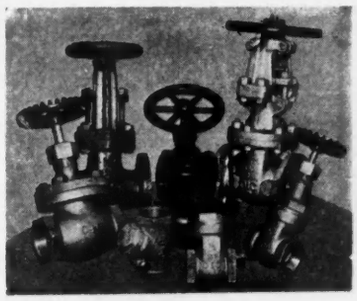
The half-inch flexible tong return cable rides over two pulleys which have been mounted on a shallow metal box welded around a rectangular opening in the four-inch pipe. To prevent the return line from fouling in the pulleys due to sidepull of the line, two half-inch bar steel brackets have been added as shown. They are channel-shaped and welded parallel to each other to limit the movement of the return line at the pulleys. These brackets guide the line into the pulleys, thereby eliminating fouling the line and delaying the tonging operation. An eye welded to the pipe cover aids in setting up or dismantling the device during rig moves.

HENRY H. PARIS DISTRIBUTOR Inc.

Manufacturer's Agent - Oil Well and Refinery Supplies

P. O. BOX 932 — 1125 ROTHWELL ST.

HOUSTON, TEXAS



"Oh I See lower costs with O.I.C. VALVES"

OIC valves give you all of these benefits: Longer uninterrupted service; Lower maintenance and replacement costs; Minimum over-all cost. They've been doing it for users everywhere, as impressive performance records attest. OIC valves are backed by more than 57 years of engineering skill, manufacturing integrity and outstanding valve performance. In OIC's you get all the benefits that it is possible for valves to render.

Agent and Distributor for the following Nationally known Manufacturers

W. C. NORRIS MANUFACTURER, INC
Tulsa, Oklahoma
Quality Pumping Equipment, Swage Nipples, Bull Plugs, Welding Fittings, etc.

WHEELING MACHINE PRODUCTS CO.
Wheeling, West Virginia
XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS. Gas-Water-Steam

THE OHIO INJECTOR COMPANY
Wadsworth, Ohio
OIC VALVES, Bronze, Iron and Steel, for all purposes. "Oh! I See Lower Costs with OIC."

HARRISBURG STEEL CORPORATION
Harrisburg, Pennsylvania
Forged Steel Flanges and Seamless Casing Couplings.

VOLCANO BURNER COMPANY
Houston, Texas
Volcano Superior and Gulf States All Steel Gas Burners for OIL COUNTRY BOILERS.

OIL STATES EQUIPMENT COMPANY
Houston, Texas
OSECO Silvertop Fusible Plugs with renewable inserts for all types OIL COUNTRY BOILERS

DRESSER MANUFACTURING DIV.
Bradford, Pa.
Seamless Welding Fittings.

Norris Quality Products

W. C. Norris swaged nipples, bull plugs, stuffing boxes, sucker rods, polished rods, welding caps and other equipment are backed by 63 years manufacturing experience, assuring the user highest quality for the utmost in efficient performance and service at no increase in cost.

... another reason why drillers prefer

Standco NO-SMOKE BRAKE LINING

Standco Brake Blocks are made of cabled cords of long fibre asbestos — woven solid and reinforced with bronze wire to prevent pulling loose on the belts. They will not burn or smoke or score brake rims.

More deep wells have been drilled with Standco than with all other blocks combined. It's your answer for low-cost hole-making.

STANDCO BRAKE LINING COMPANY

Factory and General Offices

2701-2801 Clinton Drive — **Houston, Texas**

From the Arctic

to the Tropics ...

GEOLOGRAPH

Mechanical Well Logging Service

Is being used to pioneer in the search for oil!

You, too, can take advantage of this up-to-the-minute service which records not only the formation changes as you drill, but also the exact time of day each foot is drilled ... and the down time.

REASONABLE RENTAL RATES. WRITE FOR DETAILS

"TIME WILL TELL"

THE GEOLOGRAPH CO. INC.

P. O. Box 1291 — Oklahoma City 1, Okla.

Check paraffin WITH SIW TOOLS

NEW! IMPROVED

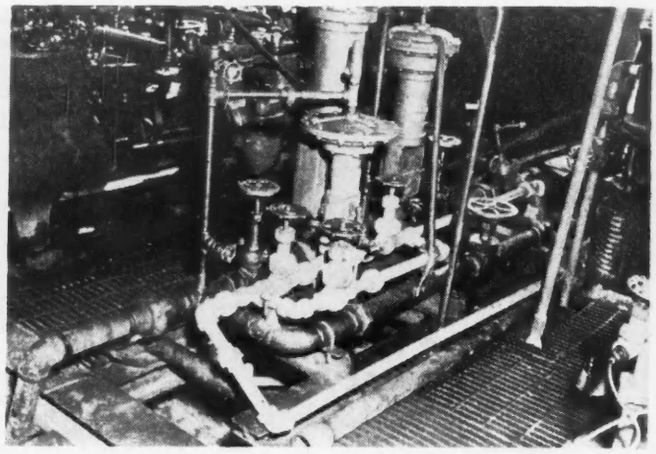
SIW Paraffin Scraper type M-25 keeps wells from choking down with paraffin, and eliminates the work of pulling and running the pump. These scrapers are field tested, and can be field-installed on new or used rods with special tools provided by the Sunshine Iron Works. Where wax is a real problem, the SIW Paraffin Scraper has proven its worth. Long, tapered wings permit each scraper to be easily run into the tube, and to be used with a rod stripper.

We manufacture many other paraffin control tools for flowing wells, pumping wells, flow lines, and well dischargers. Write us for latest bulletins!

Sunshine Iron Works

601 W. MURPHY - PHONE 4374 - ODESSA, TEXAS

HOW TO—Combine Burner and Blower Controls



Considerable piping and fittings, as well as space, may be saved by consolidating the boiler stack blower controls with the boiler burner controls. Illustrated is a compact boiler control unit mounted on one skid for ease of moving. The light colored lines are one-inch in size and control the forced draft in each stack. The line is connected to the main steam line and contains a diaphragm-controlled regulator which opens and closes the line. A bypass system around the regulator makes it possible to blow the stacks manually if necessary.

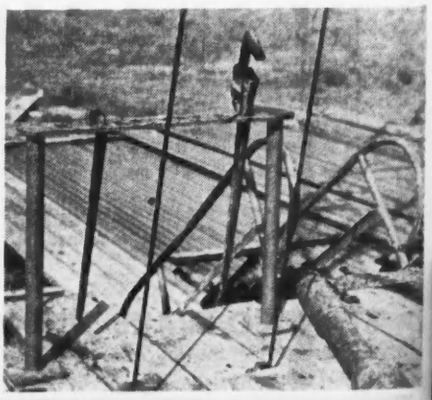
The diaphragm on the steam line is loaded by fuel gas pressure carried in the darker colored lines which are two inches in diameter. This system of regulating the amount of gas flowing into the boiler burners depends upon the steam pressure in the main steam line. When line pressure drops, the regulator opens to pass more gas and thereby generates more heat under the boilers. The gas line is equipped with two regulators: one to lower the gas pressure from field pressure to maximum burner pressure, and the second (middle regulator shown) to control the amount of gas flowing into the burners.

The unit has been condensed by mounting the stack blowing controls on top of the fuel gas controls. Three pedestals are welded to the gas line to provide suitable support for the steam lines which are secured to the larger pipe by means of two bolts and a saddle piece. The diaphragm loading lines are short and all controlling regulators are placed together on one skid in a very compact unit which simplifies the fireman's work.

HOW TO—Make Rack for Extra Floor Tools

Storing extra hand tools used on the derrick floor can be accomplished in an efficient manner through the use of a simple tool rack. Design of the rack is such that it very ably accomodates hand tools with long handles, such as pipe wrenches, stop cock handles, sledge hammers, etc.

The rack is simply a rectangular piece of ½-inch plate steel about 30 inches long and six inches wide. Various size slots have been cut in the steel plate to accept and support various size tools. Legs for the rack are made from 2½-inch pipe about 30 inches long and are welded to square steel plate bases. The rack is anchored temporarily to the derrick floor by nails driven through holes in the steel bases. The rack is easily constructed from scrap material and is handy for storing idle hand tools that are otherwise awkward to hang on a tool board.



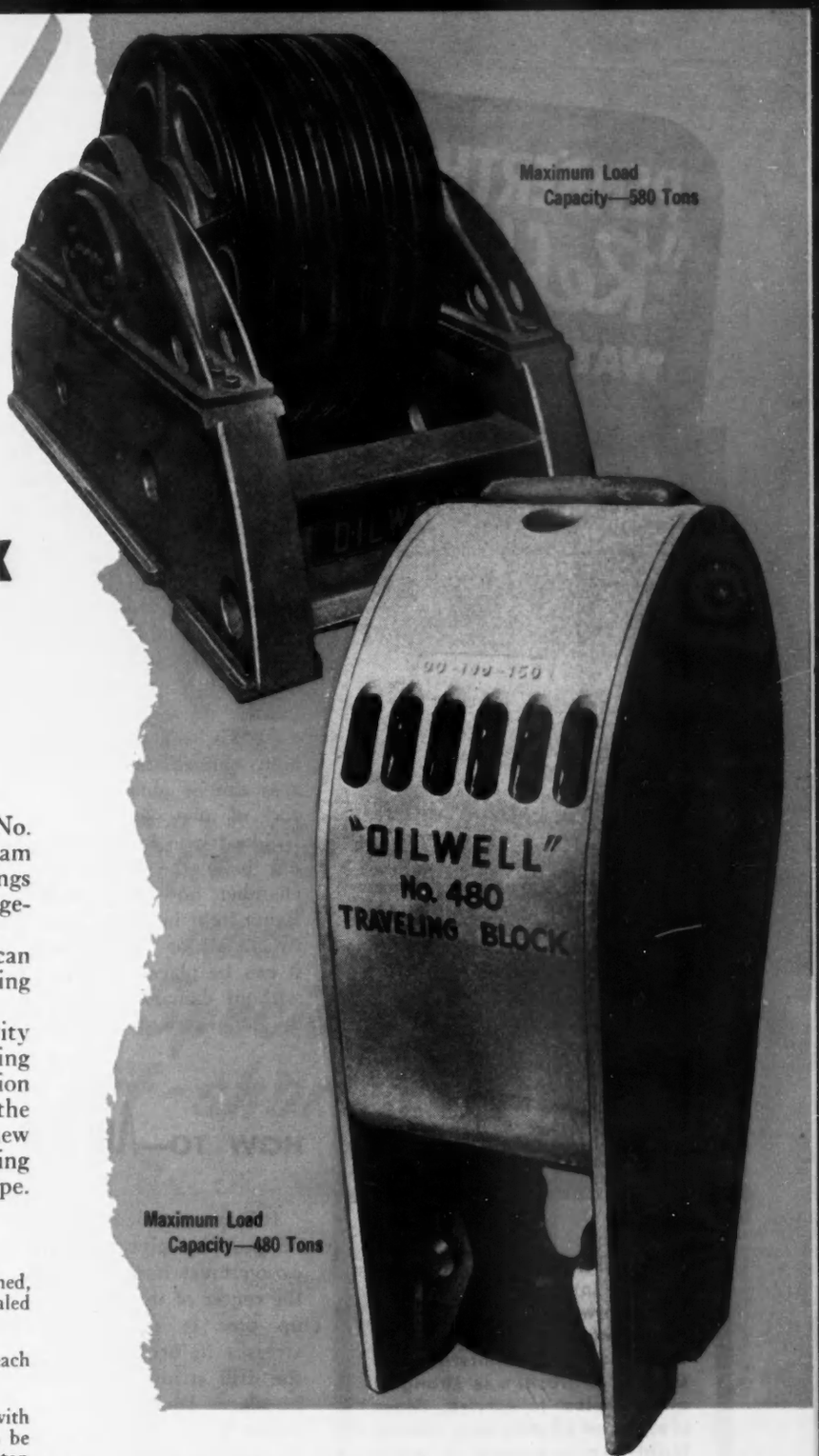
New!

Streamlined Blocks for deep-well drilling

"OILWELL" No. 580 CROWN BLOCK

and its companion

No. 480 TRAVELING BLOCK



THE NEW "Oilwell" No. 580 Crown Block and No. 480 Traveling Block form a safe, dependable team with a favorable ratio of strength to weight. Bearings and sheaves are identical and completely interchangeable.

Due to its narrow design this new Crown Block can be easily installed in one piece which is a time-saving advantage.

The balanced design with low center of gravity keeps the Traveling Block vertical even when running light at high speeds. Safety streamlined construction and free running sheaves make it possible to run the block as fast as the crew can handle the pipe. This new Traveling Block is short, as well as narrow, affording maximum space in any derrick for handling the pipe.

IMPORTANT ADVANTAGES

BEARING TYPE—Both Blocks are equipped with self-contained, dual-roller type bearings having side thrust capacity and sealed grease lubrication.

LUBRICATION—Grease, through individual connections to each bearing of each block.

FEATURES—Traveling Block is narrow, compact, streamlined, with no projections . . . has fully enclosed safety guard and can be strung without removing the guard . . . rubber bumper on top protects sheaves . . . will stand upright on derrick floor without tipping.

SPECIFICATIONS

DESCRIPTION	CROWN BLOCKS	TRAVELING BLOCK
Maximum Load Capacity	580-Tons	480-Tons
Number of Sheaves	7	6
Outside Diameter of Sheaves	50"	50"
Wireline Size	1¼"	1¼"
Centerpin Diameter	12"	12"
Overall Width	4'-2"	2'-5¼"
Overall Length	8'-0"	.....
Overall Height	4'-11"	7'-9¼"
Maximum Diameter Across Guard	....	4'-3¾"
Distance—Centerpin to Top	2'-1"	3'-0¼"

For information on other "Oilwell" Blocks please refer to "Oilwell" Booklet No. 5C-1047. Or inquire at the nearest "Oilwell" Store for complete specifications and detailed information of all Blocks in the "Oilwell" line.

OIL WELL SUPPLY COMPANY
Branches Serving All Oil Fields

Executive Offices—DALLAS, TEXAS
Export Division Office—
30 ROCKEFELLER PLAZA
NEW YORK 20, N. Y.

Division Offices—CASPER, WYOMING
COLUMBUS, OHIO . . . DALLAS, TEXAS
HOUSTON, TEXAS . . . TULSA, OKLAHOMA
LOS ANGELES CALIFORNIA

USS "OILWELL"
UNITED STATES STEEL

PENBERTHY
"Reflex"
WATER GAGE
SET

Reflex principle makes reading certain, instant and accurate. Water always shows black—steam always shows white. Water level is unmistakable. U-Bolt construction is strongest and simplest to service. Glass is replaced by removing nuts on front—unnecessary to work between gage and boiler. For oil field, locomotive type and marine boilers. Conforms to ASME, Federal and State requirements when used for pressures specified by their respective codes.

There is a Penberthy Gage for every liquid level gage requirement.

3277-E

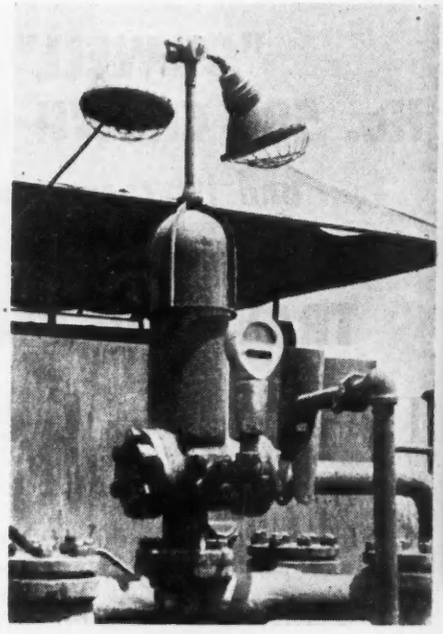
PENBERTHY PRODUCTS

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

HOW TO—Mount Flood Lights on Mud Pumps

Ample illumination of the mud pump area at a drilling well can be provided by flood lamps resting upon the shock chamber of one of the pumps. A basket-like fitting is made by forming a ring slice-cut from a joint of pipe the diameter of which is greater than the outside diameter of the mud pump shock chamber. Four ribs welded to this ring are bent in the same general shape as the cone top of the shock chamber and brought to a common point where these ends are welded to a small plate to which is attached a half-inch pipe collar into which the lamp standard is screwed tightly.

As this basket supports the flood lights high enough that illumination of the area can be obtained, nothing is in the way of men who work on the pumps. Unlike tripod lamp standards, wind will not blow the basket from the shock chamber, nor will trucks knock it over. Being light in weight, one man can easily install or remove the support and it can be placed in a box for shipment without damage to the lamps, support, or connections. The material cost is almost insignificant and the construction cost is nominal. If this fitting is given a reasonable amount of care, it should give service indefinitely.

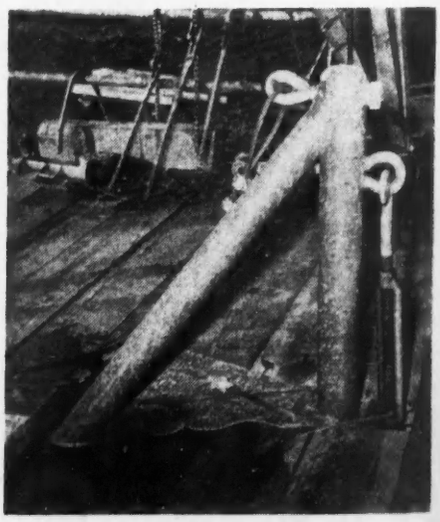


HOW TO—Anchor Backup Post for Pipe Tongs

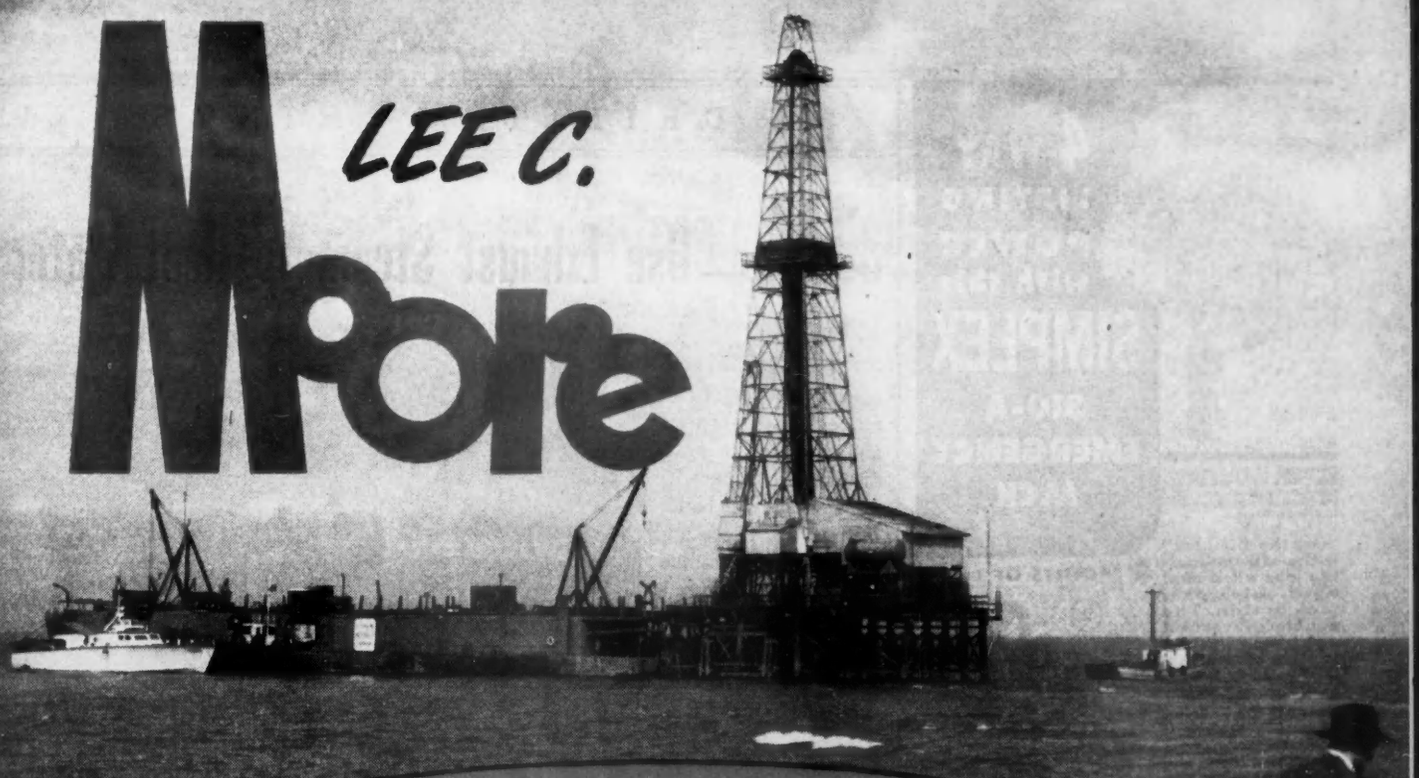
It is often difficult to anchor the backup post for pipe tongs because its location must have a definite relation to the center of the rotary. Since the backup post is subject to considerable stresses in breaking out tool joints in the drill string, it must be held firmly in place. Illustrated is a slightly different but sturdy method used to anchor the backup post in a desirable location on the derrick floor.

The backup post, made from four-inch pipe and braced by two angle supports of three-inch pipe, was first welded to a triangular base of sheet metal. The unit is located directly above one of the 24-inch I-beam sills supporting the derrick floor and rotary. Main support for the backup post is provided by a 24-inch turnbuckle which is anchored to the substructure below, where a large eye was welded to the I-beam. A similar eye was welded to the upper section of the four-inch upright, making the hookup quite simple and quick to make. The turnbuckle is tightened so that the post is held firmly in position.

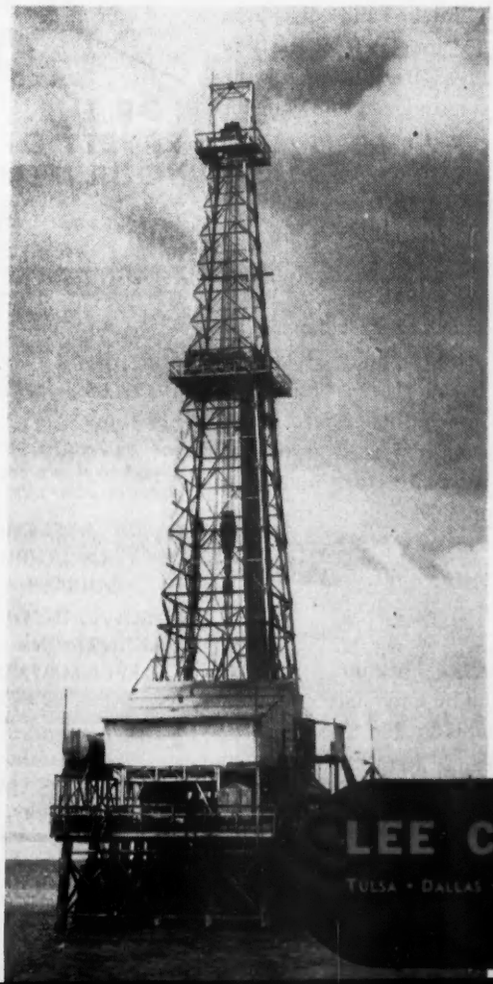
To prevent the backup post from moving around the turnbuckle as a pivot, a piece of ½-inch wire rope was threaded in a crisscross fashion through the metal plate base and wrapped around the 24-inch I-beam sill. The line is tightened and clamped in place by wire line clips.



LEE C.
Moore



Outstanding Experience in Engineering Design and Fabrication of Derricks and Special Accessory Structures for Off-shore Drilling..



Lee C. Moore's valuable experience in engineering and fabricating Heavy Series Derricks, with standard and special structures, for deep water drilling extends our progressive service.

LEE C. MOORE CORPORATION

TULSA • DALLAS • HOUSTON • MIDLAND • SHREVEPORT • WICHITA • CENTRALIA • PITTSBURGH

Export Office — 50 Church Street, New York 7, N. Y.

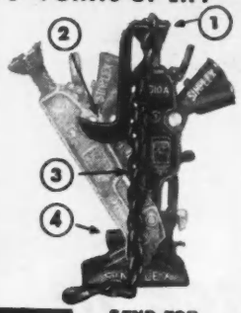
4-WAY LIFTING POWER with this SIMPLEX 310-A EMERGENCY JACK

Powerful 310-A Simplex EMERGENCY JACK is easy operating, will lift vertically or push or lift in any position.

"Get the Simplex" is the call on drilling jobs when men want quick, safe jack action. The double lever socket enables them to work in close quarters and at any angle.

This 15-ton Ratchet Lowering jack will lift or lower from four points—on the rotary cap, on the auxiliary cap shoe, on the serrated toe lift, or from any intermediate height by using the chain as a sling.

4 "POINTS OF LIFT"



SEND FOR BULLETIN: OII 48

Simplex LEVER - SCREW - HYDRAULIC Jacks

TEMPLETON, KENLY & CO.
1032 S. Central Ave., Chicago 44, Ill.

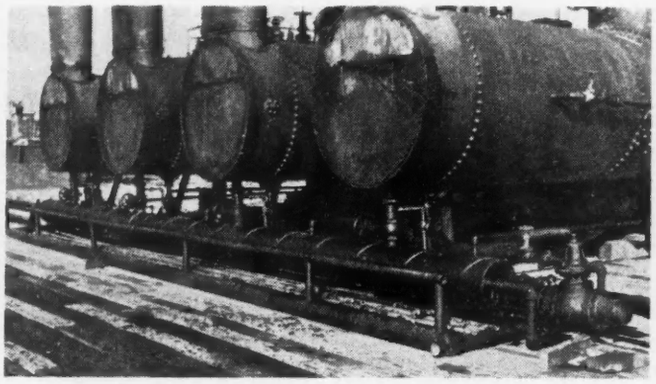
CRATING Is A SCIENCE

"FROM WAREHOUSE TO DESTINATION"

Experience proves that crating and shipping are exact sciences. Each consignment presents a different problem, to be analyzed and answered **before** the article is packed and shipped. This is Tulsa Crating's "Safe arrival" guarantee to you.

TULSA CRATING CO.
519 S. ROCKFORD, TULSA, OKLA.
Packing - Crating - Shipping
AIR . . . RAIL . . . TRUCK
DOMESTIC EXPORT

HOW TO—Use Exhaust Steam to Heat Water



Efficiencies of oil country boilers can be materially increased and the consumption of fuel decreased by preheating the boiler feed water. Since exhaust steam from mud pumps and engines possesses considerable heat, it can be utilized with undue difficulty in heating boiler feed water. One shop-made feed water heater which has proven satisfactory in the field is illustrated. It is basically a heat exchanger which has been permanently set across the full length of the boiler battery immediately below the stacks.

The heat exchanger shell is 14-inch outside diameter spiral-weld casing filled with an endless coil of 1½-inch tubing. This coiled tubing inside the casing carries the boiler feed water, connections for which may be seen at the right hand end of the unit. This end has been sealed off and connections made for both intake and discharge of feed water. A four-inch connection has been welded to the bottom of the sealed casing to provide a blowoff for steam in the event excess pressures build up in the exchanger.

Exhaust steam enters the exchanger from the lefthand end. It flows around the inside water coils, heating the water, and then exhausts out the stack blower lines shown as short risers between the exchanger and boiler shell. Thus, the pump exhaust steam serves two purposes: (1) heating the boiler feed water and (2) providing a forced draft for the boilers. If all pumps are operating and more steam is exhausted than the stack blowers can safely accommodate, causing pressure to build up inside the heat exchanger shell, the safety pop valve at right will open. A steam trap is connected to the bottom of the exchanger to handle condensed steam which accumulates inside the unit.

The boiler feed water heater and all connections have been mounted on one skid for convenience in moving. A guard rail around the exchanger unit across the front and exposed side protect it from being bumped by trucks turning around in front of the boilers. In dismantling, only the connections to the exchanger are broken and the unit moved. It is easily set up again, since only a few connections need be made.

GERONIMO

FOR THE SAFETY OF YOUR MEN

DERRICK ESCAPE MECHANICISM

NET WEIGHT 15 LBS.

GLIDE TO SAFETY ON GERONIMO
(Patent Applied For)

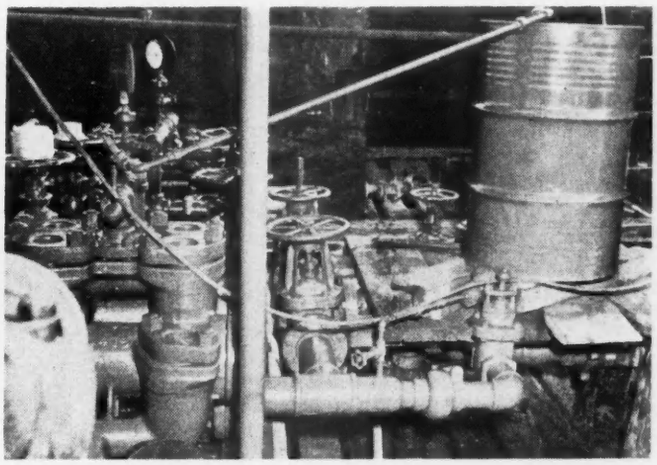
GERONIMO will stand hardest wear and give unfailing protection to refinery and derrick men whose lives are endangered by fire, escaping gases or other hazards.

EASILY ATTACHED OR REMOVED
EXTRA STURDY CONSTRUCTION
QUICKLY STRADDLED
POSITIVE, INSTANT BRAKE
BRONZE "No-Spark" SURFACES
RECOMMENDED FOR ½" WIRE LINE

• Write for Illustrated Folder •

SOLD THROUGH YOUR SUPPLY STORE
— MANUFACTURED BY —
CHARLIE'S MACHINE WORKS
PERRY, OKLAHOMA

HOW TO—Add Chemical Water Softeners to Boiler Feed Water



Control of physical and chemical characteristics of boiler feed water is recognized as a practical method of reducing boiler overhauls. Feed water is treated not only with chemicals to reduce scaling and surface tension, but it is also filtered by some operators. The problem of adding the various chemicals to the feed water has brought about many methods and equipment designs. Here is a method of adding water softners to the boiler feed water by means of a simplified hookup requiring only a few pieces of pipe and a discarded oil drum.

Water is first heated by the feed water heater, then pumped into the boilers as required. It is between these steps that the chemical is added. The drum into which the chemical is fed is located at or near the fluid end of the feed water pumps and is elevated above the feed water pump suction to give a reasonable head pressure.

The 55-gallon drum, supported on a crude timber platform, is tapped on the bottom where a ¾-inch pipe collar is welded. Bottom of the tank is connected to the feed water pump suction by a ¾-inch line which is equipped with a check valve and globe valve. The line is welded directly to the suction line as shown.

Water to dissolve the chemicals is furnished by the feed water pump through a ¾-inch line which is tapped into the pump discharge. This water line is welded into a bull plug screwed to the discharge tee. The line is equipped with a globe valve to control the flow of water into the drum as needed.

The dissolved chemicals are drawn into the pump suction through the ¾-inch line attached to the bottom of the drum. The valve is regulated to provide the desired chemical feeding rate. The check valve prevents suction line water from backing up into the drum.

HOW TO—Increase Rigidity of Derrick Floor

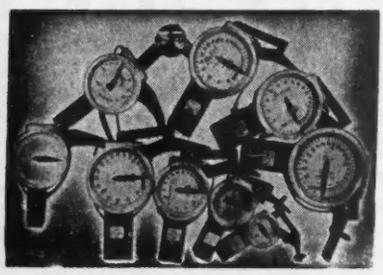
In a move to provide greater rigidity for the derrick floor structure around the rat hole opening, one drilling company designed and assembled an unusually sturdy framework made of salvaged steel rails. Welded together as shown, the box-like structure spans the opening between two of the derrick floor girders and is designed to remain intact when the floor sections are torn down to moving size. The flat steel plate to which the upper lip of the rat hole pipe is welded rests across the rail structure. Provision of this underfloor structure removes weight of the swivel and kelly from the floor supports spanning the more widely spaced principal I-beam members.

Gotkool
WATER CANS
& COOLERS
Gott
GOTKOOL
WATER COOLER
PURE WATER
GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.
GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug fitting large removable top, handy non-leaking push button faucet. GOTT Water Cans for handy field use. Your Supply Store has them, get one today! . . . .
H. P. GOTT MFG. CO.
WINFIELD, KANSAS
GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. (Push Button Faucet at slight additional cost.
KEEP PURE DRINKING WATER ALWAYS HANDY

MASS PRODUCTION?
NO!
NOT IN OIL EXPLORATION!
CAREFULLY INDIVIDUALIZED GEOPHYSICAL WORK ADAPTED TO THE FACTS IN EACH PARTICULAR CASE, BOTH IN THE FIELD AND IN THE OFFICE.
KLAUS
EXPLORATION CO.
LUBBOCK, TEXAS

Sterling
PUMPS • HOISTS • LIGHT PLANTS

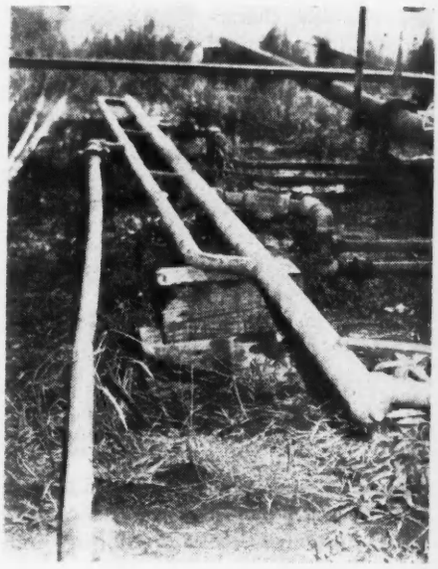
DEPENDABLE
RUGGED
SIMPLE
•
SAVE MONEY
SAVE TIME
STERLING QUALITY
For more detailed information see pages 3984 and 3985, Composite Catalog.
STERLING
MACHINERY CORPORATION
405-13 SOUTHWEST BLVD. KANSAS CITY 10, MO.


20 MODELS
LINE SCALES
40,000 to 500,000 Lbs. Capacity!
Widely used because they are always accurate, sensitive, rugged — and economical. With a Line Scale you KNOW the pull on the line, and the weight on the bit, in pounds! See your local supply man for details.
LINE SCALE CO., Inc.
907-11 SE 29th, Box 4245, Phone 6-1765
Oklahoma City, Oklahoma

HOW TO—Distribute Gas to Boiler Burners

Where a straight gas header is used to feed fuel gas into the burners, the boiler nearest the supply will draw more gas than the remaining boilers in the battery. Such a situation results in uneven output from each boiler. The problem of providing an equal distribution of fuel gas to all boilers was solved by a unique manifold which supplies gas to a header at points which are equal distance from the burner connections.

A header of three-inch pipe spans the boiler battery and is connected to each burner through taps into the header. These connections are equal distance apart and equipped with plug valves. Fuel gas is fed into the header through a sub-header of 2½-inch pipe. The sub-header is connected into the three-inch header at points which are midway between the burner connections. A 2½-inch supply line coming from the burner control unit is connected to the mid-point of the subheader. Such a design causes the gas to travel the same distance and through corresponding sizes of pipe to reach each burner, thus resulting in an equal pressure distribution to each boiler.

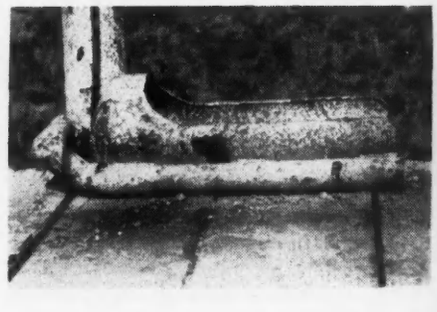


In the particular installation shown, three boilers are used; however, such a setup can be made for any number of boilers provided the principle of distribution is followed. Two cross braces of one-inch pipe have been added between the two headers for added strength.

HOW TO—Make Protector for Drill Collars

Gouging and demolition of walkway planking by drill collars can be prevented by using a sled-type protector when laying the heavy collars down. A short nipple of pipe of the size into which the pin of the drill collar will enter easily is used for the body of the planking protector. It is closed at one end with an orange peel weld but the upper part of the body is cut away so that the end of the drill collar can be more easily inserted when lowered by the high-line to the walk-way. The body of the planking protector is supported upon two parallel pieces of two-inch pipe shaped like the runners of a stone-boat.

When bending the pipe to form the runners, special attention is given to the shaping of the knees to see that they are perfectly smooth so the sled will slip easily down the walk-way planking while the drill collar is being brought out from the derrick to be stacked on the pipe rack. The up-turned ends of the runners are tied to each other with a short nipple of two-inch pipe to prevent spreading, while the body is welded to the runners at three points on each side. So that the sled-type planking protector can be lashed to the end of the drill collar, ears are welded on opposite sides of the body for throwing a half-hitch of soft rope around the end of the drill collar when it is lowered into the body of the protector.

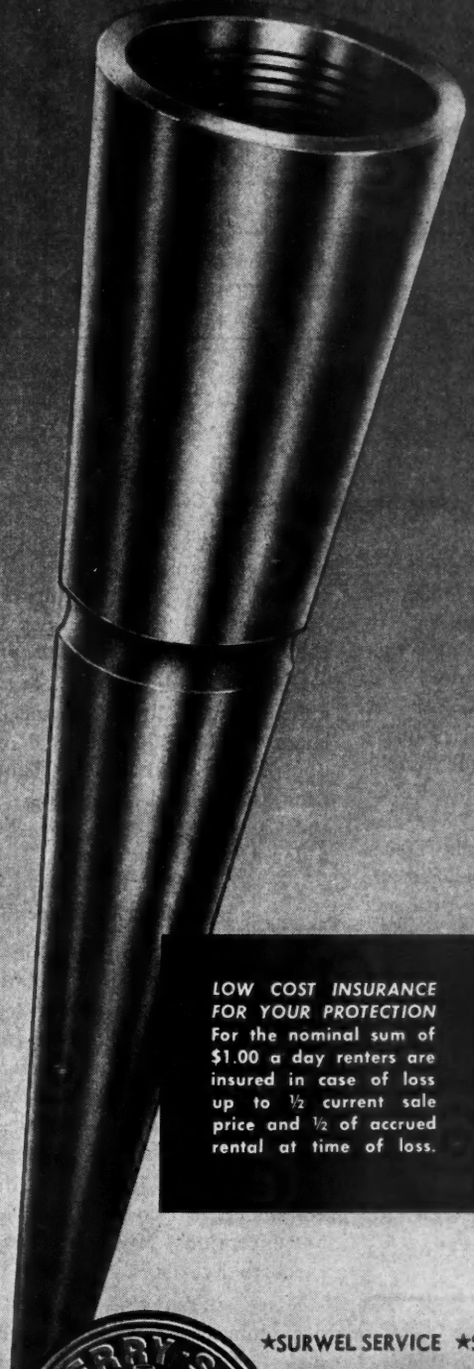


DIRECTIONAL SURVEYS

while you

DRILL

with S-S Non-Magnetic Drill Collar Rentals



Particularly advantageous in directional drilling the S-S NON-MAGNETIC DRILL COLLAR makes it possible to take directional single shot records *inside* of the *drill pipe*. It eliminates removing the drill pipe from the hole or raising the string off bottom to allow the surveying instrument to hang through a specially designed bit. You save rig time—You get more accurate records.

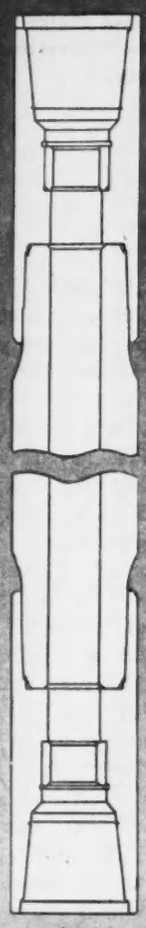
The S-S NON-MAGNETIC DRILL COLLAR is positioned immediately above the regular bit, the non-magnetic portion carrying the directional single shot instrument . . . *fully protected from loss and damage.*

Records are more accurate because the instrument is seated inside the drill collar in positive parallel to its walls.

The non-magnetic sections of S-S DRILL COLLARS are made of "K" Monel steel with the same high physical properties and strength found in conventional collars of steel.

S-S NON-MAGNETIC DRILL COLLARS are available on a low-cost daily rental basis in standard sizes from 4¾" x 14' to 7¾" x 23'.

Complete information and price list gladly furnished on request



Sectional view of S-S Non-Magnetic Drill Collar

LOW COST INSURANCE FOR YOUR PROTECTION
For the nominal sum of $1.00 a day renters are insured in case of loss up to ½ current sale price and ½ of accrued rental at time of loss.

★SURWEL SERVICE ★SYFO CLINOGRAPH ★E-C INCLINOMETER ★NON-MAGNETIC DRILL COLLAR

SPERRY-SUN WELL SURVEYING COMPANY

3118 BLODGETT AVENUE HOUSTON, TEXAS

Philadelphia, Pa. Falfurrias, Texas Odessa, Texas Marshall, Texas Long Beach, Calif. Oklahoma City, Okla.
Lafayette, La. Bakersfield, Calif. Moulden Oil Field Services, Casper, Wyo.

Cotton County Poor Boy's Paradise

By JAMES D. PATE

A SPECTACULARLY SUCCESSFUL shallow play in Cotton County, Oklahoma, has attracted many "poor boy" operators. This regional article describes drilling and production methods, and provides a thumbnail geological sketch that may be applied in the search for new pools in the area.

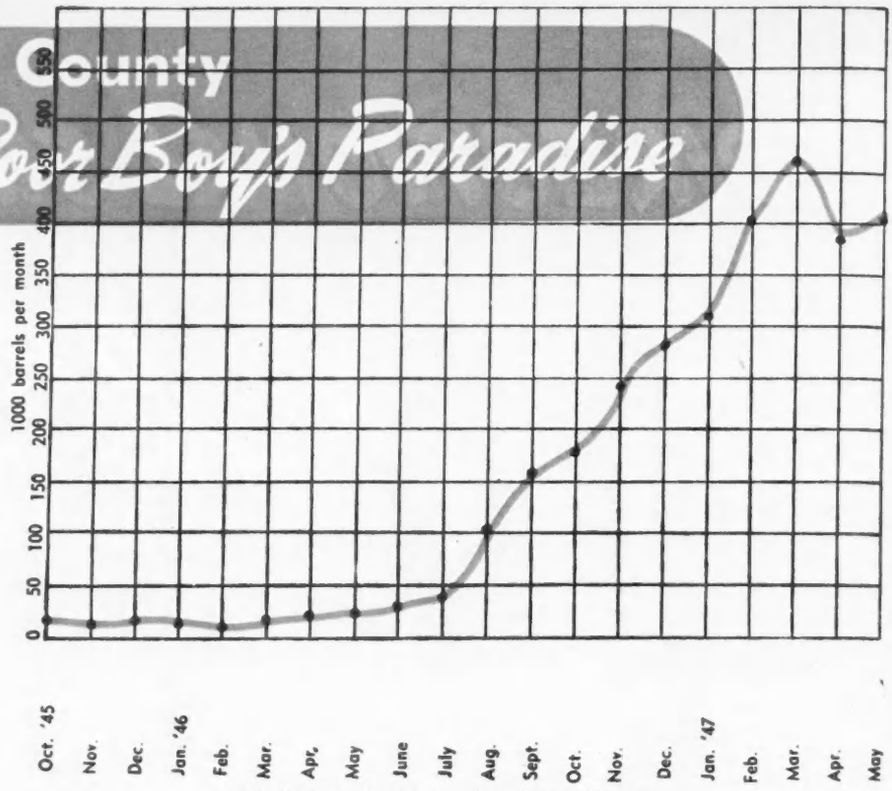


FIGURE 1. Production graph of Cotton County.

WHEN the oil industry today is thinking in general in terms of deeper wells, Cotton County, Southwestern Oklahoma, has proved a "poor boy's" dream and a wildcatter's paradise. There are few sections of the country where comparatively shallow areas have paid off as fast as in Cotton County, although the ratio of failure has been about 25 to 1. This has not deterred drilling operations where wells are of the "post hole" variety and can be completed in a few days at an approximate cost of $6000.

Oil was first discovered in Cotton County in 1917, but it was not until May, 1946, that the county became an important producer. During the latter part of 1946 a daily production of 9000 barrels was attained and since that time production has steadily increased to about 15,000 barrels daily (Figure 1).

Between the development of the old Walters field, discovered in 1917, and the Bridwell discovery of the Essaquanahdale pool in May, 1946, there were no commercial oil fields opened in Cotton County. Although the county seems to have been neglected during that 30-year interval, several hundred dry holes were drilled in search for oil. Nine wells were drilled within a square mile, one-half mile from the Cache Creek proper. All were abandoned after slight shows of oil and gas.

J. S. Bridwell of Wichita Falls, Texas, started the recent "boom" when he completed a 27-barrel per day producer in Section 23-3s-11w, from the Cache Creek sand at 1490 feet. After a few offsets were completed, Stanolind Pipe Line Company laid a line to the new area as a "good will" gesture. Then came discoveries at Cache Creek, Soldier Creek, Cookietown, and Randlett. Two months after the Bridwell discovery, scores of wildcats were being punched into the ground over the entire county. Independent operators acted fast and leased virtually every acre in the area. Major companies have entered the play in a serious way and Phillips Petroleum Company and Cities Service Oil Company now have considerable production.

Geology took a back seat and the independents literally speckled the county with wildcats drilled on nothing but "acreage." Lawyers, bankers, and druggists leased land and contracted their acreage to be drilled. The result: a dry hole ratio of 25-1.

Drilling Practices

Practically all drilling in the producing areas of Cotton County is done by the rotary. A few early wells in the Walters pool and scattered wildcats were drilled with standard tools. Sticky shale sections of the Permo-Pennsylvanian formations make cable tool drilling slow and difficult.

A few wells have been drilled and completed in two days; however, these are exceptions. Most wells require from three to five days.

After spudding a nine-inch hole, the first hundred feet is reamed to 13¾ inches. Generally 100 feet of ten-inch surface pipe is set; then drilling is resumed. After finding the sand with one nine-inch rock bit, seven-inch casing is cemented with 40 to 50 sacks. While pumping equipment is being set up a spudder is moved in to drill out the plug and penetrate the sand four to eight feet. Coring has been attempted in several of the wells without good re-

About the Author

JAMES DURWOOD PATE graduated from the University of Oklahoma with a B.S. Degree in geological engineering in 1944. After serving two years with the U. S. Army Engineers, he returned to the University of Oklahoma and obtained a M.S. Degree in geological engineering in 1947. He is now affiliated with the Republic Natural Gas Company at Oklahoma City.

sults since the sand lenses are coarse and essentially unconsolidated.

Drilling costs have been cheap in the new development since all formations down to the pay are soft and easy to drill. Generally, one bit only is used. Present drilling contracts call for $1.50 to $1.75 per foot. An average well may be drilled and completed for less than $6000.

Mast-pole portable rigs are being used in the development of new pools (Figure 2). Pumping equipment in all pools except Essaquanahdale and Walters consists of a pumping jack electrically operated by 7½ horse power motor (Figure 3). Wells in the Essaquanahdale pool are pumped with Pennsylvania-type pumping jack connected to a central power unit. Most of the wells in the old Walters pool are being pumped by Oklahoma-type pumping jacks connected to a central power unit. Figure 4 shows twin wells at West Cache Creek being pumped by two jacks in combination operated by one electric motor.

Wildcatting

Since the discovery of the Walters pool, wildcats have been drilled over the entire county searching for the prolific Cisco sand. Until the recent development, wildcats had been disappointing, contributing no oil and very little geological information. At present wildcats are being drilled continuously over the entire county and should eventually lead to the discovery of new shallow pools and extensions to the old ones.

A 440-foot spacing between wells has been used in the development of the county; nine wells staked per 40 acres. On several leases odd spacing patterns have been used in fence-line drilling; however, the 440-foot pattern is most common. Most leases in the old Walters pool have been drilled using ten-acre spacing. A few wells were spaced as far as 850 to 900 feet apart at first; then later wells were drilled between these locations.

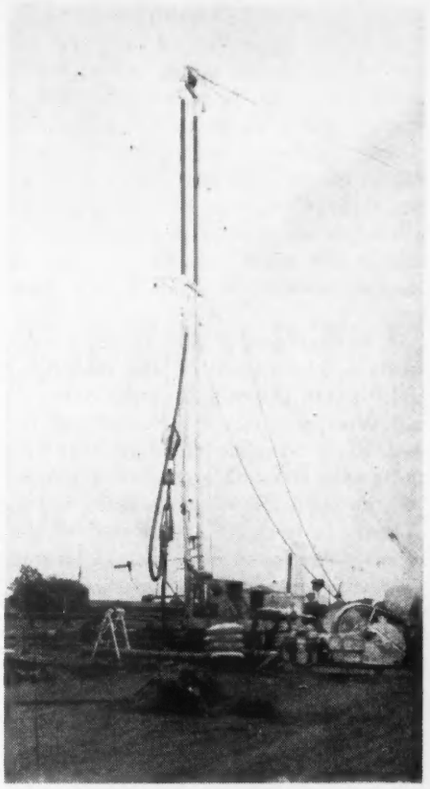


FIGURE 2. Mast-hole portable rigs are being used in the development of new pools.

Evidence of folding in late Permian is found near Cruce in Stephens County to the northeast of Cotton County where the Duncan sandstone is sharply folded. In Comanche County, just north of Cotton County, gentle folds have been found in the surface rocks of the Wichita-Clearfork formation which are similar in magnitude to the folds found in Tillman and Cotton counties.

Permian folding must have been very gentle since many of the surface structures are apparently not reflected in the lower beds. In fact, many of them are in areas that are regionally low.

The surface structure of the western half of Cotton County was worked extensively by Malcolm J. Munn of the U. S. Geological Survey in 1912. He used as a key bed a peculiar conglomeratic lentil consisting principally of limestone with small included balls of red and gray clay. This lentil is Wichita-Albany in age and has been named the Auger conglomerate lentil from the exposures on Auger Creek and also at old Fort Auger in Sec. 6-5s-15w. In the course of this study the Auger lentil was traced for several miles. There appeared to be two similar layers of conglomeratic limestone lying together. Probably many of the points were taken on the lower lentil; however, an error of less than eight feet would result. An examination of Figure 5, which is based on Munn's work, reveals that the only surface closures found are in the vicinity of Devol near the Tillman County line. North and east of this townsite there is a northwest-southeast trend called the "Devol Anticline." The two highest points on the trend appear to be in Secs. 27 and 28-4s-13w and Secs. 6, 7, and 8-4s-13w. South of the Devol Anticline there appears to be a small syncline trending parallel to the anticline. Lying north and roughly parallel to the Devol Anticline is a broad flat syncline with an axis pitching slightly toward the southeast, modified somewhat by several shallow basins. This long basin was called the Deep Red Syncline.

South and southwest of Randlett some closure is indicated, but there are not enough points to properly orient the structure. There is an anticline on the Megargel, Canyon, and Arbuckle formations in the same area indicating that the subsurface Arbuckle "high" is reflected on the surface. This structure is now producing oil from shallow Pennsylvanian sands.

Subsurface Structure

The subsurface folding responsible for the structures favorable for the accumulation of oil and gas in Cotton County may be subdivided into (1) Wichita Uplift, (2) Red River Uplift, (3) Arbuckle Uplift, and (4) Permian Folding. These regional uplifts are the source of all the folding and faulting in Southwest Oklahoma and have a direct relationship to

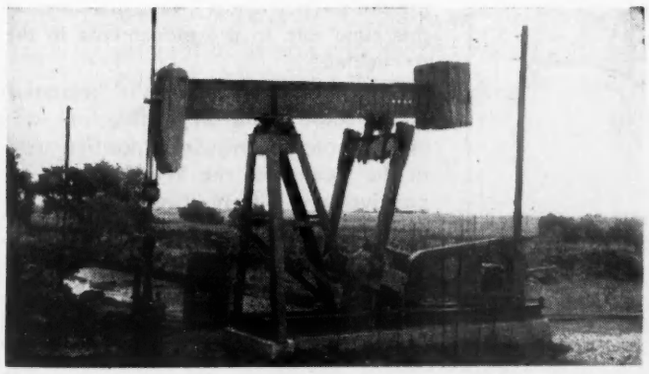


FIGURE 3. Typical electrically operated pumping jack in use in new pools.

FIGURE 4. Twin wells at West Cache Creek pool pumped by two jacks in combination operated by one electric motor.

the structural geology of Cotton County.

Clyde M. Becker, in his study of the Wichita Mountain area, believes there were two periods of uplift in the mountains. The first uplift, which raised the southwest ridge, was in the Mississippian period, the second in the Mid-Pennsylvanian. His evidence that the southwest ridge is the older is based on the fact that the granite wash which flanks this ridge is thicker by hundreds of feet than the eroded material which flanks the other granite ridge. Another condition which indicates that the southwest ridge is older is the fact that the granites are more faulted than in the central and northeast ridges.

This late Mississippian orogeny which gave rise to the dominant structural feature of Southwest Oklahoma dates the earliest movement in Cotton County. As the southwest ridge was being eroded down, it contributed heavily to the sediments comprising the Cisco group which produces all the oil in the county.

The Red River Uplift as a whole is a buried structural feature which lies adacent to Red River from Denton County to Cottle County in north-central Texas. This buried range has an east-west extent of nearly 200 miles, yet its width is never over a few miles. The general opinion seems to be that the uplifting of this arch was contemporaneous with that of the Wichita Mountains. The fact that Canyon, Strawn, and possibly Bend sediments are deposited unconformably against the south side of the ridge is positive evidence of uplift before Bend time.

If Pennsylvanian and younger sediments were stripped off the Red River Uplift north to the axis of the Arbuckle and Wichita Uplift, one would find the Red River syncline trending east-west and a spur trending northwest-southeast off the Red River arch into Cotton County. It is on this spur that all the recently developed oil pools are located.

Another major uplift responsible for much of the folding and faulting of Southern Oklahoma rocks is the Arbuckle Uplift which occurred near the close of the Pennsylvanian period. This uplift was undoubtedly slow and intermittent throughout Cisco time, giving rise to the lenticular deposition of the sands which produce all the oil in Cotton County.

Evidences of Permian folding have been found over much of southwestern Oklahoma. Examples are the anticlinal folding in the vicinity of Devol and sharp folds in the Duncan sandstone at Cruce in Northwest Comanche County. Evidently this folding is related to the late movements of the Llano Uplift in Central Texas since the north dip of the surface rocks to the north of that region continue in a northward direction across Red River into Oklahoma.

Permian folding in Cotton County and surrounding counties must have been very gentle since many of the surface structures disappear before attaining any appreciable depth.

Relation of Strand Line to Production

In studying the accumulation of oil in the new Cotton County pools equal weight must be given to structure and sedimentation. Structurally, the new production is located along a buried granite ridge trending northwest and southeast across the county which is probably a spur off the Red River arch. The pattern of the pools and the nature of the Cache Creek sand deposition suggest that the buried spur was a strand line for advancing seas coming out of the Marietta Basin during most of Cache Creek time.

To further illustrate the sedimentational history of the Cache Creek sands four hypothetical diagrams are included as Figure 6. These diagrams, A, B, C, and D, represent the position of the strand line along the buried spur during the successive stages of sand deposition. Although only one sand lens is illustrated, a number of such depositional features would be formed both vertically and laterally provided the sea was a shallow and oscillating body of water such as that which existed in Cotton County and Southern Oklahoma during Cisco time.

Diagram A of Figure 6 represents the initial condition in which the shallow Cache Creek sea advanced upon the partly structural and partly topographic area which was unstable at this time due to the movements in the Arbuckles.

Diagram B represents the beginning of off-shore sand deposition of sediments brought down from positive areas in the vicinity of the Wichitas and the positive area itself. Good sorting of clastic sediments would be expected, since the sand would be dropped first and the finer silts and clays which remain in suspension longer would be carried farther and deposited in the deeper waters of the Marietta Basin. Mild off-shore currents which may be postulated in a shallow sea would tend

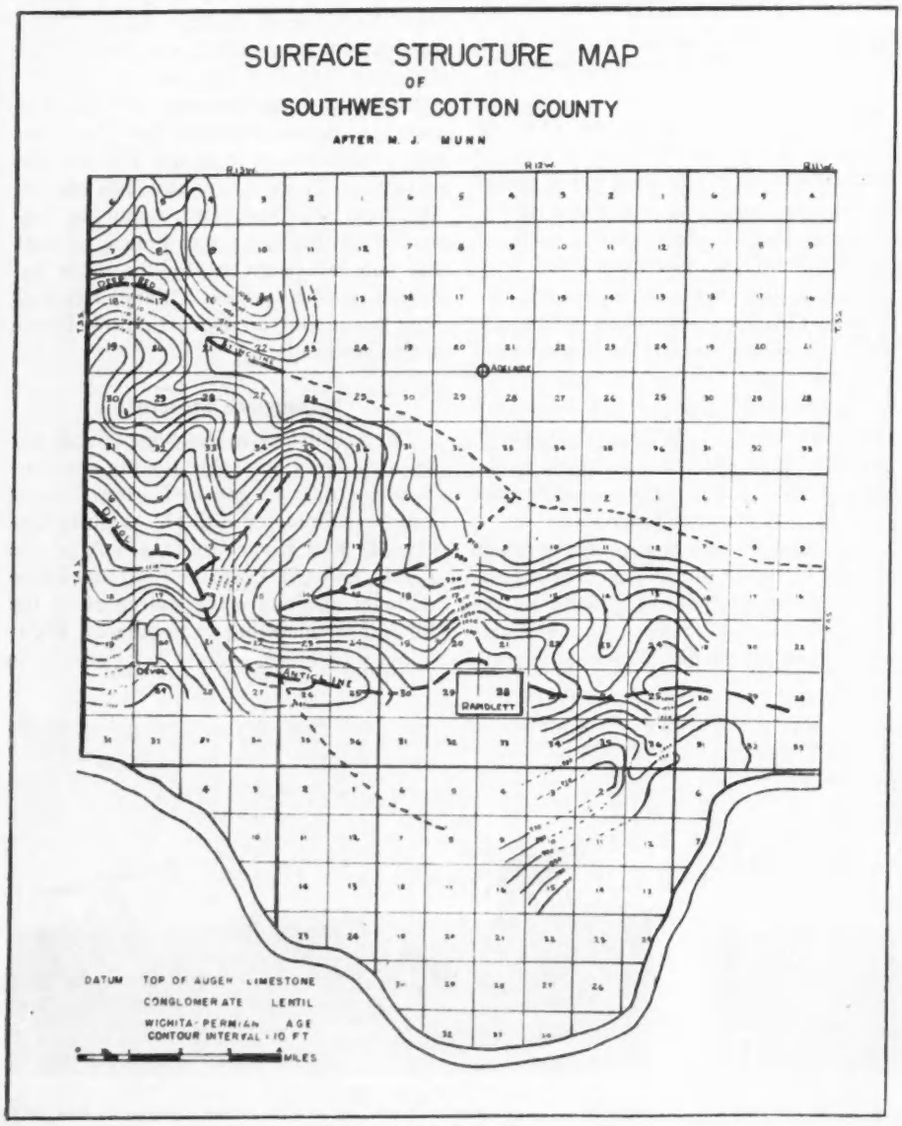


FIGURE 5

HUNT EXPORT MODEL BIT

Accepted by Every Major Operator in Foreign Fields

It's so easy and fast to replace blades in the field in the HUNT EXPORT MODEL WELDED-IN BLADE BIT that operator after operator has standardized on this new bit. Any bit dresser can easily make the change. There's no chance for error because blades seat in only one position . . . in the two, three or four blade types. No jigs, fixtures or gauges are needed. Blades are pre-ground in our plant to full gauge with the proper amount of inserts and hard metal. Hunt Export Model Welded in Blade Bits were specifically designed for remote locations where complete shop facilities are not available. Write for our illustrated folder.

HUNT TOOL COMPANY

HOUSTON · TEXAS

FIELD SHOPS: Houston, Bay City, Corpus Christi, Jennings, Harvey
EXPORT SALES: Hunt Export Company, 19 Rector St., New York
Advo. Pte. R. Saenz Pena 832, Buenos Aires
Port of Spain, Trinidad

HUNT TOOL COMPANY

A BUSINESS BUILT ON *Good* SERVICE

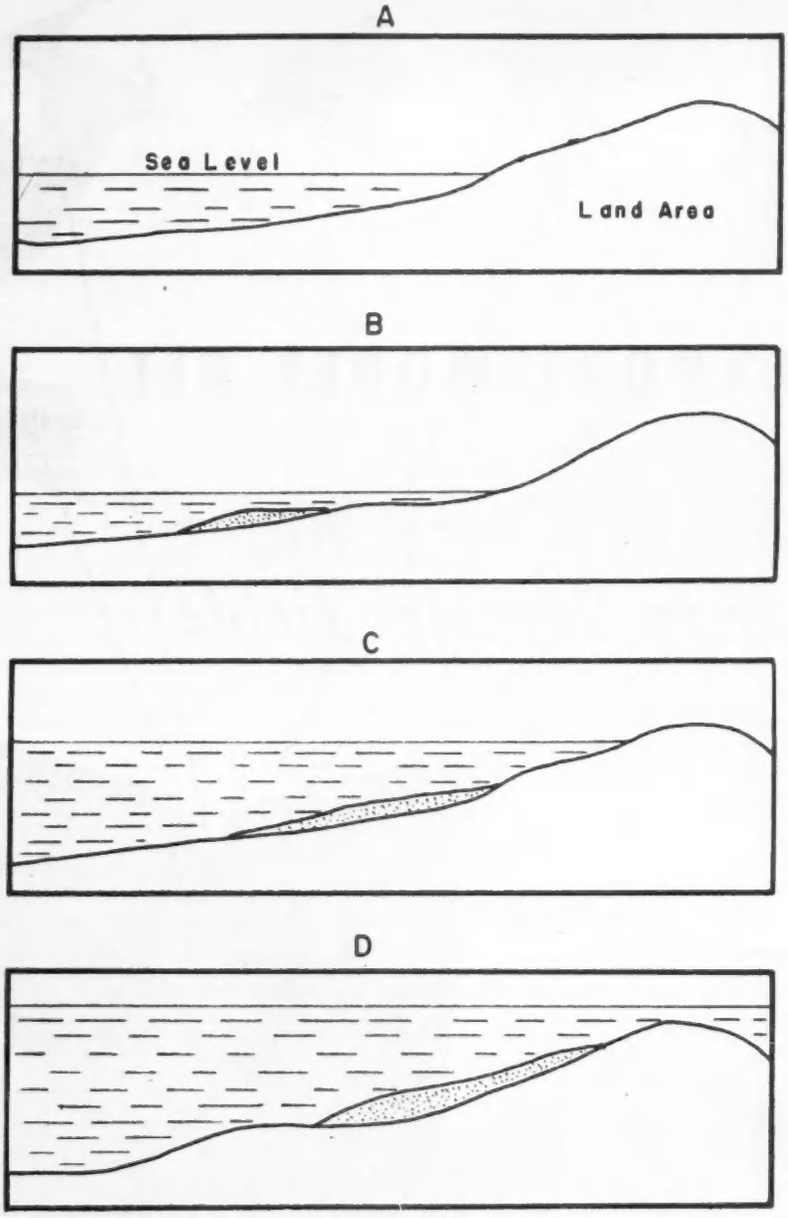


FIGURE 6. Successive stage of sand deposition on high areas along subsiding coast line.

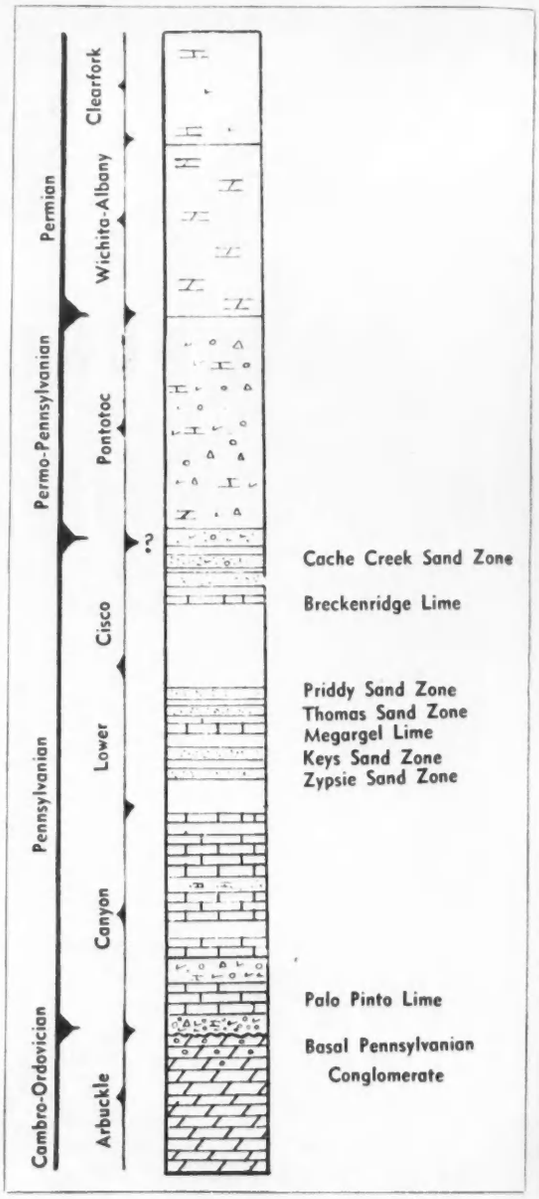


FIGURE 7. Type log of Cotton County showing principal formations.

to wash the sands clean, forming a potential reservoir for oil.

Diagram C represents the condition expected as the land subsided allowing the sea to advance toward the crest.

In diagram D the crest of the "high" has submerged below sea level, and the ridge is no longer subject to erosion by surface agents. Fine clastics and mud would be deposited on top of the ridge, but potential reservoir sands would be lacking due to the shallow depth and greater distance from the new strand line.

The above explanation seems to satisfy the sand conditions found along the buried area in Cotton County.

The oil in the shallow Cotton County pools probably originated close to where it is being found. The shales of the lower Cisco and Upper Canyon formations which enclose the sand lenses seem to be the likely source. The compacting forces exerted during the period of probable differential settling literally "squeezed" the oil, with salt water, from its source into the sand reservoir around which the settling took place. As to whether the migration of the oil was upward or downward into the sand lens, little evidence can be offered.

Future Oil Possibilities

After drilling a score of deep wells over the county, most operators have given up hope of finding production in the deep Canyon lime zone and in the Arbuckle dolomite, as both zones yielded only salt water on tests. It appears then that future exploration in the county should be confined to the buried ridge and its flanks and drilled to a depth sufficient to reach the lower Cisco shales which lie on top of the Canyon limestone. Wells drilled in the basins east and west of the buried high prove that the Cache Creek sand zone graded into shale going away from the ridge, which condemns a greater part of the county for future production. It is possible, but not probable, that there are a few isolated structurally high areas within the two basins which have not been found by the drill and may be productive in the future.

Along the buried high between Cache Creek and Soldier Creek there is much proven acreage to be drilled up, as well as the discovery and development of new pools.

ACKNOWLEDGMENT

The author acknowledges the assistance given by Dr. Carl A. Moore of the University of Oklahoma; Carl T. Anderson of Oklahoma City; George W. Dimock and Ralph A. Birk of Wichita Falls, Texas, as well as the courtesy of the Republic Natural Gas Company of Oklahoma, for much valuable information and permission to publish this article.

By GILBERT M. WILSON
Staff Writer

Combination Unit Speeds Workovers

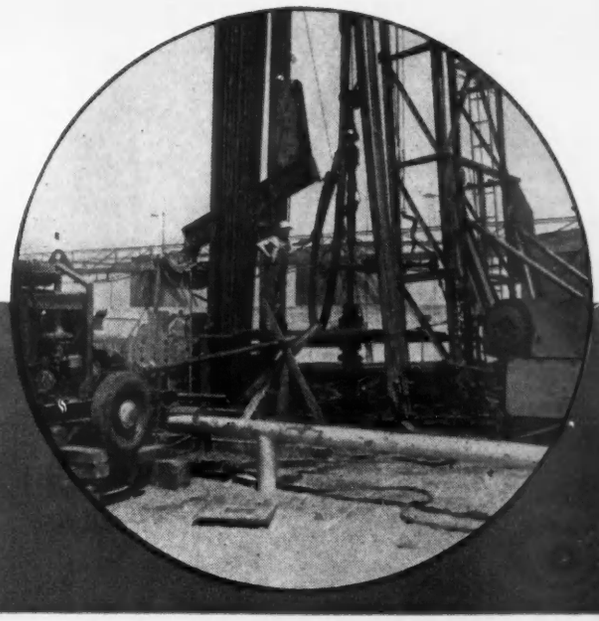


FIGURE 1. Powered by the small trailer-mounted engine outside the derrick floor area, the small portable rotary table is shown in operating position on well casinghead. On this installation are special protective covers for drive shaft between engine transmission and rotary head. Housing is length of tubing equipped with a bearing on each end through which drive shaft turns. With housing stationary, danger of men becoming caught in shaft is eliminated.

A READILY portable combination drilling head and rotary table being used by a number of California operators is simplifying the work of deepening, drilling out of cement and plastic plugs, rolling out collapsed casing, and numerous other repair jobs which formerly required large conventional rotary drilling equipment. Employed in San Joaquin Valley and Los Angeles Basin fields with considerable success, the unit has made possible the economical reworking of many wells which otherwise might have remained in a neglected condition due to the expense of moving in heavy drilling equipment.

The drilling head is a compact unit combining the essential elements of a small rotary table, kelly bushing, slips and bowl. In addition, it has built within it a rubber packoff element which rotates with the kelly, and which serves as a blowout preventer while drilling or when running tubing. The small unit is mounted directly atop the casinghead, where it is secured with a quick-attaching union. Figure 1 illustrates a typical installation in which it is being used to drill out a plastic plug at a depth of about 2900 feet.

Used With Production Equipment

The small table (Figure 2) generally is used in conjunction with regular production equipment such as well pulling hoist, portable mast if well is not equipped with derrick, tubing block, light swivel, rotary hose, and pumps. Often these auxiliary pieces of equipment are unitized and skid mounted, piping manifolded, etc., to further simplify setting-up operations and supplement the portability of the rotary unit. Use of nipples or flange adapters of various sizes permits the mounting of the head on any size well casing.

Motive power for the table may be supplied by either a remotely located separate engine, electric motor or takeoff from the drawworks engine, driving through a drive shaft to a pinion drive and ring gear within the head. A gear ratio of not less than 3 to 1 is recommended between prime mover and drive shaft. Universal joints on both ends of the drive shaft take up discrepancies of vertical or horizontal misalignment between engine and rotary head.

In the majority of installations, power is supplied by a small engine mounted on a two-wheel trailer or portable skid base which can be set up outside the rig floor area where it is out of the way of workmen and less likely to cause fire or explosion should well gases collect near the casinghead. Another factor making it desirable to keep the power unit at some distance from the floor area is that on producing wells the area generally is taken up by pumping unit, lead lines or other equipment, hence the need for keeping at least part of the rework equipment as far away as possible.

In addition to being able to handle routine drilling jobs employing conventional circulation, and if necessary under pressure, the drilling head is particularly adapted to use of reverse circulation, a procedure commonly used in workover jobs. The oil-resistant, accordion-shaped pack-off element is available in sufficient sizes to permit the use of numerous sizes of drill pipe and tubing. Drill pipe up to 2⅞-inch using three-inch square or hexagonal kelly and having a tool joint diameter of 3¾ inches or less, or tubing of from 1¼- to three-inch size (the latter non-upset), are safely handled without loss of fluid or pressure when the proper pack-off element is used.

The drilling head is designed for a working pressure of 1500 pounds per square inch. It has been used for drilling to depths of 6000 feet, but at such depths the drilling string usually is of 2½-inch externally upset tubing, or combination

A COMBINATION UNIT has been developed which speeds up the operation and reduces the cost of workovers and which is small enough to be moved in without heavy trucking units. The unit is described and some of its applications shown in the accompanying article. One interesting phase of the work is the use of the equipment as drilling head for well abandonment.

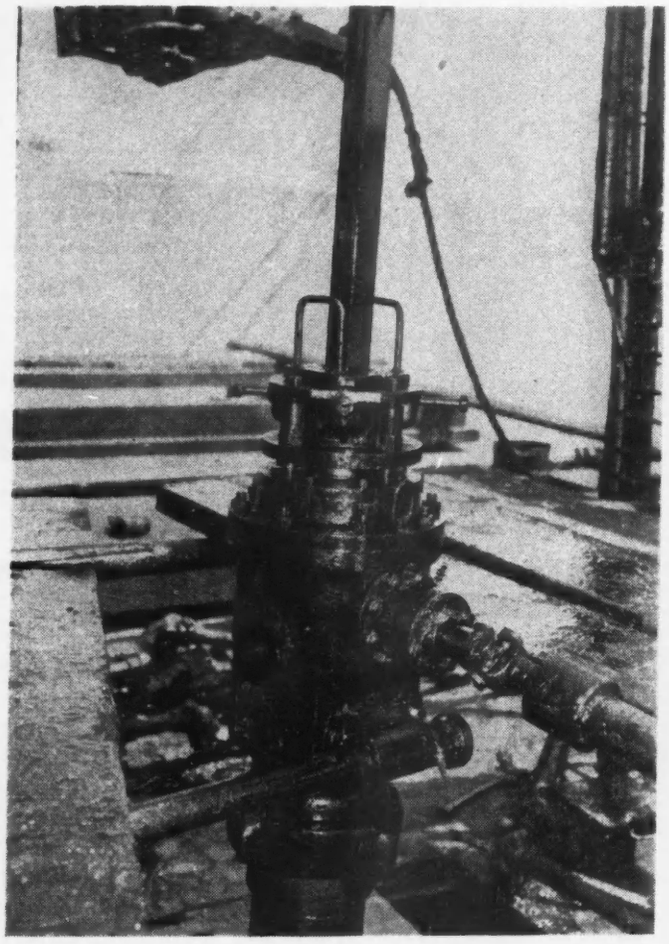


FIGURE 2. Closeup of rotary drilling unit showing method of installing on casinghead with quick-attaching union. Universal joint equipped drive shaft and safety housing are visible at right. The length of tubing attached to lower part of head is anti-torque device which prevents tendency of head to rotate when table is in operation. Other end of pipe is secured to any convenient anchor such as derrick leg or pumping unit base.

FIGURE 3. Small table contains essential features of conventional rotary table. Here, slips are being set in bowl preparatory to breaking out a stand of drill pipe. Accordion-type packoff element which rotates with drill string is contained within body of drilling head.

strings of 2⅞- or 2⅜-inch drill pipe. Recommended kelly speeds range from 75 to 125 revolutions per minute.

Numerous Applications

Typical of the jobs which the unit is capable of handling was that involving the drilling out of a 400-foot cement plug in a well at Wilmington. Top of plug, in 8⅝-inch casing, was at 2450 feet. Using a 7⅞-inch rock bit with wall scraper on 2⅞-inch drill pipe, and 3-inch by 12-foot drill collar, a production department crew of four men completed the job in two tours. Only two hours were required to rig up the drilling head and prepare for drilling. Conventional truck-mounted production hoist and pump unit with special rack-mounted tanks were used.

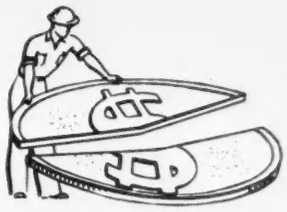
Other types of jobs which the unit has performed successfully include diamond bit coring, milling over a fish, and rolling out collapsed casing. A pipe rolling job recently completed in a Los Angeles Basin well was that of an 8⅝-inch, 36-pound string which was collapsed along a four-to-five-foot interval at about 3000 feet. Principal precaution in such an operation is to rotate fast and carry plenty of weight on the roller. Drilling new hole and routine cleaning out of sand bridges or remedial work are jobs easily handled by the small unit. The 6000-foot job referred to elsewhere involved the drilling out of a plastic plug in 6⅝-inch casing.

An operator in the San Joaquin Valley area uses the light drilling head in preparing for abandonment of depleted wells, finding it much quicker and more economical to rig up with this light equipment than with conventional rotary tools. In several instances wherein it was necessary to make new hole, it was found that footage could be made at about the same rate as could have been made with regular rotary equipment.

The use of tubing as drill pipe is an increasingly common practice in some areas, the only factor limiting its use being the fact that threads wear out much faster when subjected to this type of service. Because of this, N-80 tubing, equipped with tool joints, has been utilized, thus materially extending the useful life of the light weight drill string.

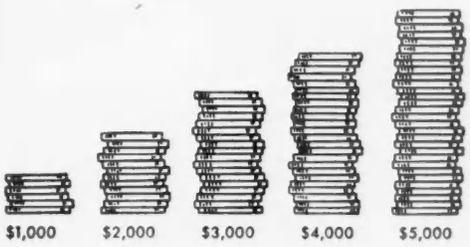
Usefulness of the small drilling unit is broadened by the use of reverse circulation, a process ideally suited to the conditions found in redrilling, drilling out plugs and general clean-out work. Because the cuttings are returned through the drill string and at a much higher velocity than possible with conventional circulation, drilling ordinarily progresses at a much faster rate. In addition to the advantages of the increased carrying capacity of the returning fluid, there is less tendency for cuttings to settle back to the bottom of the hole to be redrilled or cause possible sticking of the bit.

Maintenance other than routine servicing or lubricating has proved to be a small factor in the operation of the tool. In numerous instances, the replacement of the pack-off element from time to time is the only work needed even after the unit has been in service for a year or two, the period depending upon the amount and type of work performed. The comparatively small size and light weight of the drilling head simplifies hauling to and from a job and when it is not in use, it is easily stored or racked.



YOU CUT PUMPING COSTS

15% TO 40%...



AND SAVE UP TO

$5000.00 PER WELL

ON EQUIPMENT...

Multiple installation, with header manifold equipped to quickly add new wells to system.

KOBE, INC. *General Offices:* Huntington Park, Calif. • *Division and District Offices:* Avenal, Bakersfield and Ventura, Calif.; Vernal, Utah; Oklahoma City and Tulsa, Okla.; Brownfield, Corpus Christi, Dallas, Houston, Longview, Odessa and Wichita Falls, Texas; Natchez, Miss.; Hobbs, N. M.; Great Bend, Kan.; New York.

WHEN YOU SWITCH TO

MULTIPLE *Free-Pumping*

These two great developments of hydraulic pumping–Multiple Operation and Free Pumping–give you maximum economy in lifting oil and greater operational flexibility.

By eliminating the pulling and running of subsurface pumping equipment, Free Pumping saves you from 15% to 40% on your pumping operating costs. Multiple Operation reduces your equipment investment as much as $5,000 per well.

In addition to this substantial saving, Multiple Free Pumping gives you centralized control, centralized bottom hole information and makes your pumper completely independent of outside help. By the turn of a valve, he can surface and run a Free Pump. In 30 minutes, he can accomplish what it would take a crew of four men eight hours to do in changing a conventional pump. This means more oil in the tanks and less downtime.

If you have not investigated the economies made possible by Multiple Free Pumping, call your local Kobe representative. He will be glad to show you comparative cost figures.

THESE ARE THE DAYS OF FREE PUMPING

Chemical Removal of Aluminum Pipe Sections

By C. E. CLASON
Halliburton Oil Well Cementing Company

THE use of aluminum pipe sections, or windows, in the oil string placed opposite oil shows is gaining wide application throughout the oil fields. Some operators use such sections at the bottom of the string with the idea of getting better results from gun perforating than might be expected through steel. Other wells are equipped with perforated aluminum liners of various lengths, which are plugged or removed after the formation is depleted.

Mechanical methods for removing this pipe have proven rather costly. Total removal of a bottom section, liner or window often can be done more easily, quickly, and at less expense with a chemical method.

A window is opened after a lower formation has been abandoned. The well is then plugged back to the aluminum pipe section. For uniform action and total removal of this section with chemicals, the well must be plugged back, preferably with gypsum cement leaving not more than five or six feet of hole below. Otherwise, there will be a concentrated action near the bottom of the aluminum section and a breakthrough will occur before the upper part is completely removed. The same can be true with open hole below an aluminum section at the bottom of an oil string.

Normally, the chemical reaction works from the top downward, so that a breakthrough can occur before the process is completed. This may allow oil to come in, so that it will be noticed when the bailer is used in removing reacted batches. This is to be expected in some cases and does not mean anything, so the process may continue according to directions.

The chemical solution used is not an acid. It is an active alkaline mixture of caustic soda and sodium nitrate dissolved in amounts to make the correct strength and proportions in water. The chemical reaction generates a heat that has a theoretical temperature of over 1100° F.; the aluminum pipe dissolves into a soluble compound and ammonia gas is formed. The great heat breaks up all cement behind the pipe section. This cement is usually picked up by the dart bailer.

There is no action on the steel pipe as would be the case with an acid solution, which would also generate the explosive gas, hydrogen. Acid is not practical for this work for various reasons.

Chemical removal has been done after gun perforating, by having the well fluid bailed down below static level at the start in order to have pressure exerted toward the well bore from the formation. This will act to hold the chemical solution in place rather than to permit flow outward through the perforations. Occasionally it is found advisable to bail down between batches when oil comes into the well.

When a well is properly plugged back, it will take from three to five batches of the chemical solution to dissolve all of the aluminum, depending upon the size of the pipe and upon its being either thin wall or regular grade.

These batches can be placed with a dump bailer in the same manner as gypsum cement. The reacted product is removed, after each batch, with the operator's dart bailers. The time consumed depends somewhat on the depth of the well (Figure 1) but as a rule from six to 12 hours will complete a job. Enough bailer sections should be used to run each batch all in one dump, if possible.

For each batch in dump bailer work, the necessary water is added to the mixer and the sodium nitrate dissolved. Then the flake caustic is added slowly until it is all dissolved. This is then put into the bailer and dumped on bottom. Each batch is bailed out after the reaction with a dart bailer. Batches should never be made up and allowed to stand but should be used while still warm, if possible.

A light steel bailer should be used to dump the chemical mixture. A four-inch bailer can be used for any size aluminum section. The sections needed will depend upon the length of the aluminum pipe to be removed. For instance, if 30

USE OF CHEMICALS to remove aluminum pipe sections is gaining wider application in the Mid-Continent areas. In California, where such sections are usually drilled or milled out, the technique was recently successfully applied for the first time. An operator in the Montebello field near Los Angeles had set a 163-foot section of 6⅝-inch O.D. extra heavy (10¼-inch) aluminum pipe at 6229 feet, total depth. Crews unsuccessfully milled the pipe for 45 days at an estimated rig time cost of $32,000. Adapting the chemical technique herein described, the section was removed in 48 hours at a cost estimated at less than 5 percent of the amount which had previously been spent in milling and reaming.

feet of seven-inch heavy wall pipe were to be removed, this would call for 46.3 gallons of solution per batch. A four-inch bailer at .6126 gallons per foot would need at least 75 feet to hold this amount.

If 150 feet of four-inch light steel bailer is taken as a maximum to run in a well, the limits for lengths of aluminum pipe to remove by dump bailer are as follows:

54 feet of seven-inch thin wall
60 feet of seven-inch regular or heavy wall
99 feet of five and one-half-inch regular or heavy wall (would work for 100 feet)
91 feet of five and one-half-inch thin wall

If the well is shallow enough and conditions are such that a single batch requirement can be split in two and both halves dumped within 30 to 40 minutes, the dump bailer method may be used. This may not occur as long lengths are more apt to be used in wells at a depth requiring pipe too long to run a bailer in the required time, but it can be done where feasible.

Aluminum in excess of these amounts should be removed by the tubing circulation method.

Removal of Aluminum Packers or Retainers

Any packer or retainer made of aluminum may be removed, provided the solution can be kept in contact. Most packers or retainers are made and placed so that the solution may penetrate through the walls on the top section, allowing solution to flow inside and down into the well. In each case, a heavy mud or blanket material will have to be spotted below and up to the tool in order to prevent this loss into the remainder of the well. Otherwise, the whole well bore below the tool would have to be filled with the chemical solution.

Other than this, the weight of the packer or retainer, as to its aluminum content, will have to be known and enough chemical solution put in to react with it. Pressure head and bottom hole temperature can be observed for time of reaction. The metal should dissolve if there is nothing in the well to prevent contact. It should be remembered that any other metal composing these tools will be liberated and, unless fastened, will fall into the well.

Reaction Under Pressure

Regardless of how the chemical solution is put in the well it will work under pressure of a head of oil, mud, or water. Figure 1 shows the time to allow for each batch reaction under varied conditions of fluid pressure head and bottom

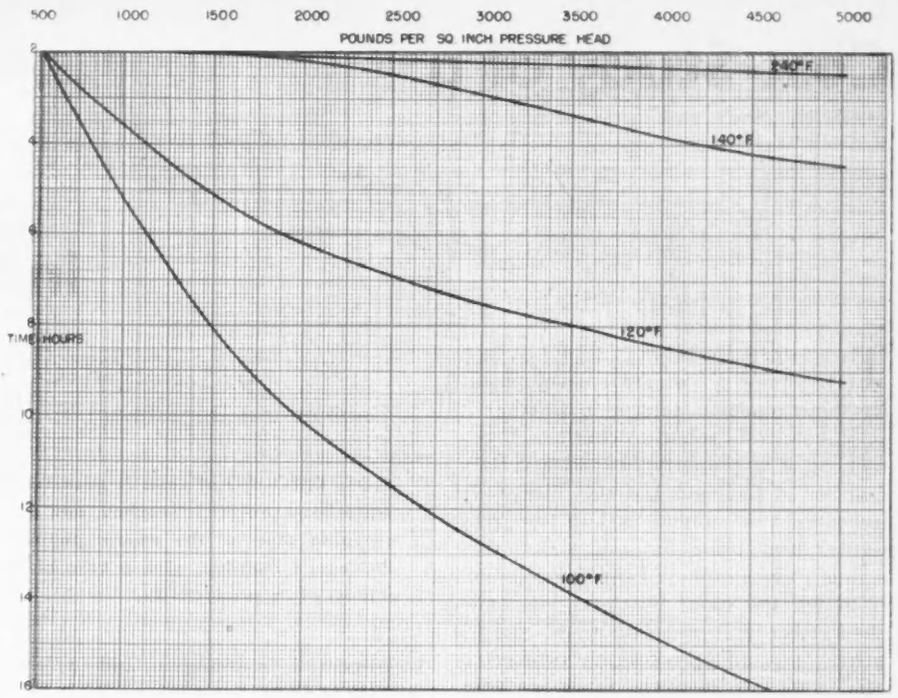


FIGURE 1. Aluminum pipe chemical reaction showing time of contact for each batch under varying temperatures and pressures. Other bottom-hole temperatures can be interpolated.

hole temperature. Timing should start when the batch is in place.

When an aluminum bailer is stuck in a well, it can be removed by the same chemicals used in removing aluminum pipe. Using the size of the bailer, the chemical solution needed can be computed in the same way as that for pipe. Then it is put in the well at once, when possible. All exposed metal of the bailer is more apt to be taken care of this way than in any other manner, where bailing out separate batches cannot be done. Naturally, if part of the bailer is buried, there will be no action on it.

If the amount of chemical solution is larger than is practical, considering available bailer sections, capacity of mixer, etc., the solution may be placed in two or three batches, as fast as it can be made up and lowered into the hole. Continuous reaction is needed to assure use of the required chemicals. Three hours must be allowed after the last batch is in place.

The well can be bailed down, if possible, to insure a low head or none of fluid. Otherwise, from the known head, the time given in previous data for reaction under pressure before cleaning out may be used.

Aluminum calling for larger amounts of chemical than can be mixed in a gypsum cement mixer can be taken care of by using the measuring tank and pump on a cement truck. If the tank is galvanized, the solution will remove this coating. This may be prevented somewhat by coating the inside with a heavy oil or grease. Trucks with aluminum tanks can not, of course, be used.

The solution used should be made by first dissolving the sodium nitrate in the water, then slowly adding the flake caustic to this. It should be circulated with pump until dissolved and used in well as soon as possible afterward.

Method of Application

For liner or window removal, assuming the well is bottomed or plugged back to the aluminum section, tubing should be run to bottom of this section. Then the batch of solution is pumped through the tubing to fill the liner or pipe section and any hole below. After reacting for the correct time, the batch is circulated completely out through the tubing by pressuring the casing and the following batch put in, etc. Any hole below the liner must be filled and this depth should be added to the liner depth. The open hole means a waste of chemicals on the first batch only, as none will be removed from below the tubing. Succeeding batches can be refigured and adjusted accordingly if the volume is sufficient to justify it.

The circulation method allows removal of a bottom section that is relatively close to one above. With the well closed in, the chemical solution is held down and cannot attack above its level.

Time of contact varies, depending upon bottom hole temperature and the head of fluid, which may be mud, water or oil. (Figure 1.)

On all deep high bottom-hole temperature jobs, if fresh water is not used to fill or kill the well, a final batch consisting of water only should be run, allowing it to set for two hours before

■ CONTINUED ON PAGE 141

Cost Study of a *Waterflood Development* in Bradford, Penn.

By J. K. BARTON and R. G. PRENTICE
Engineering Department, Quaker State Oil Refining Corporation

CLOSE CHECKING of costs is necessary to determine when the economic limit of a waterflood project is reached, and equally as close scrutiny is required to prevent stopping short of the payout point. The authors, in an article appearing in the *Producer's Monthly*, give a case history on a lease which was developed to the utmost of its productivity.

THIS study of an actual development has been made to determine whether it is economically sound to continue development of a property beyond a certain number of five-spot layouts. The study indicates that under certain recovery figures and price for oil, a company stands to lose money if the development is halted too soon. Further, this study shows that it is unsound to try to develop too small a piece of marginal property with low recovery rates per acre.

The cost figures used herein are actual cost of materials and labor, as of December, 1947, used in a development of a property of the Quaker State Oil Refining Corporation, Bradford, Penn. The data for the cost of wells were obtained from actual cost figures of eight producers and 11 intakes already completed on this property. These cost figures may appear low. In this respect three points should be kept in mind: (1) the operations were carried out under experienced and able field supervision, (2) a central purchasing agent aided in keeping material costs to a minimum, and (3) some second hand materials were used.

The total cost figures are on a per five-spot basis and include development, electricity and gas, maintenance and extra labor, pulling, pumper, power and pressure plant costs. The time interval used to obtain the assumed recoverable oil of 1600 barrels to the acre was seven years. Data for recoverable oil were obtained from core reports on the property.

Development Costs

Table 1 shows the individual cost figures for an average of eight oil wells and 11 water wells already completed.

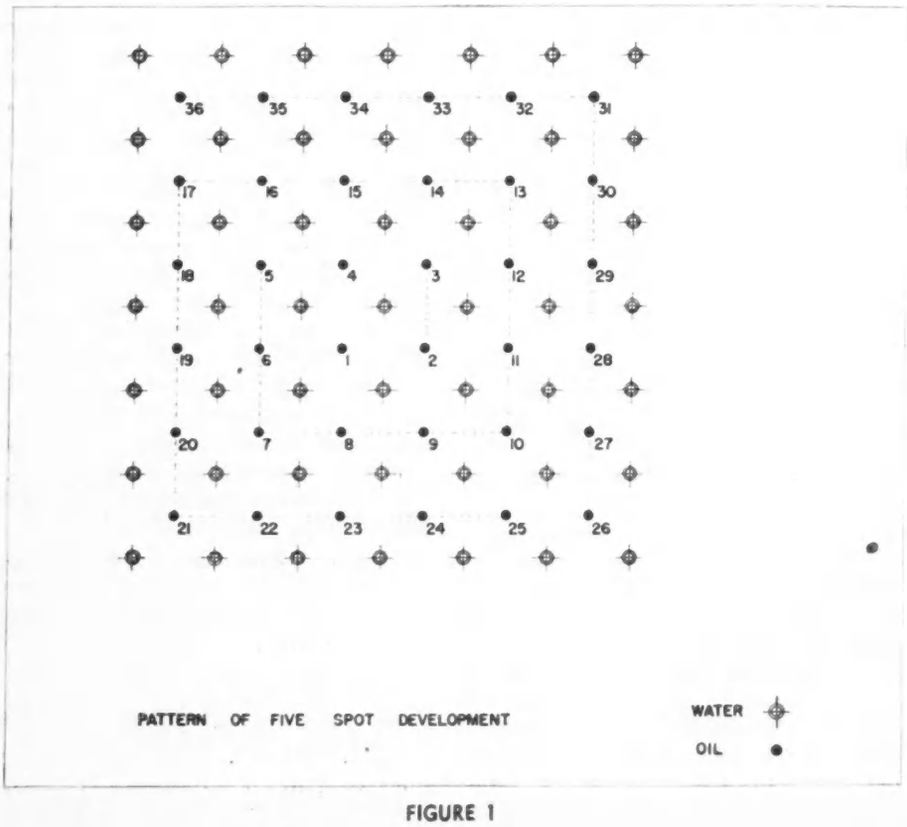


FIGURE 1

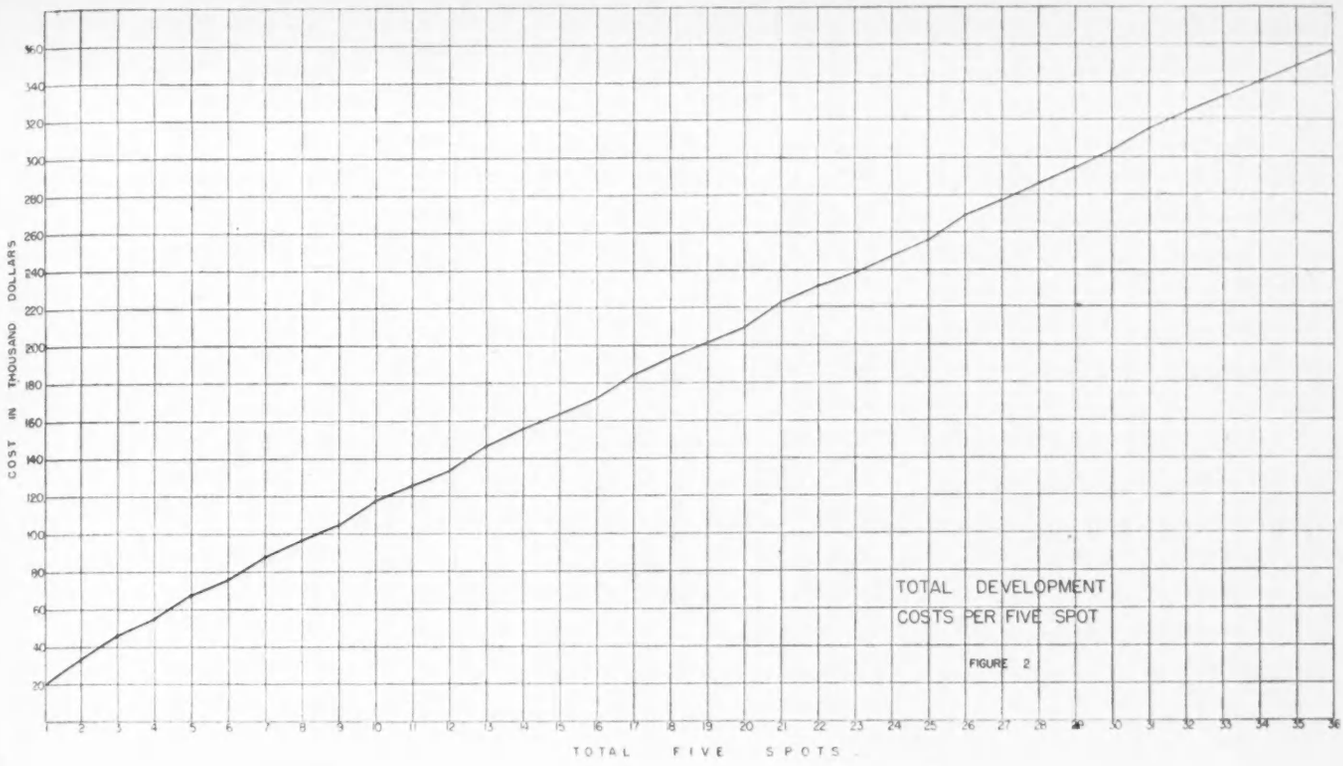
From these figures a development cost was used of $4400 for each oil well and, as two-inch tubing was to be used for all future water wells, the cost for future water wells was placed at $4050 per well.

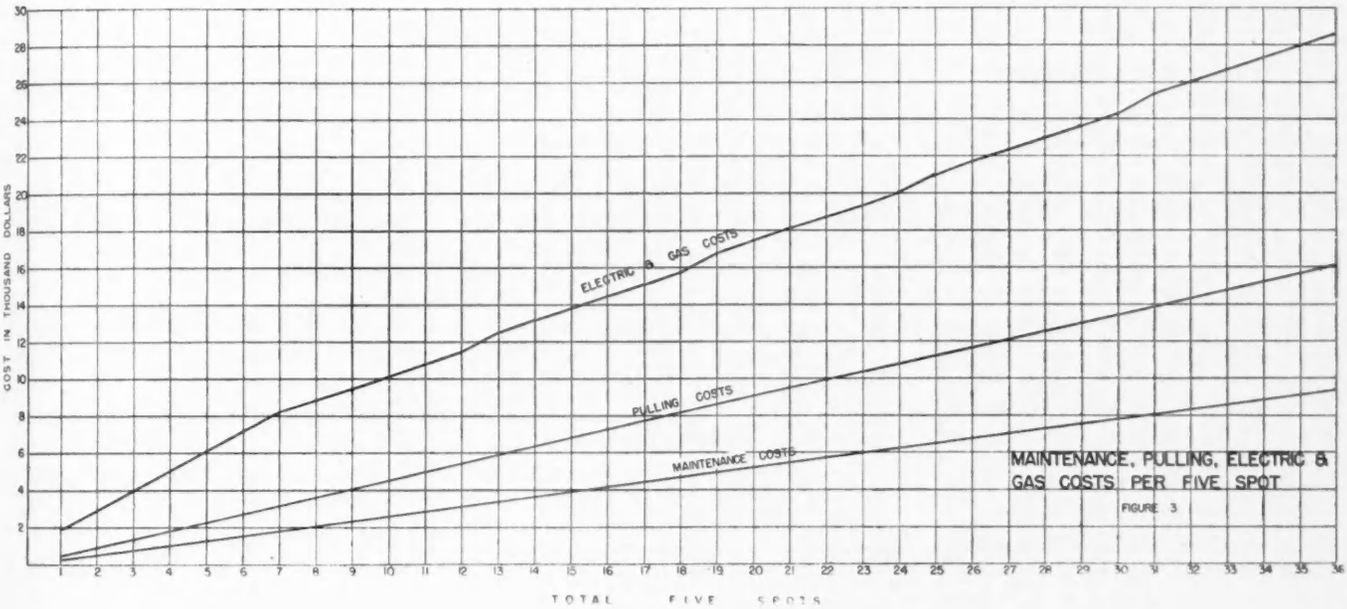
The property was developed in a pattern as shown in Figure 1. The development curve, as shown in Figure 2, shows the total cost as each additional five-spot was completed.

Maintenance, Pulling, Electricity and Gas Costs

Figure 3 gives a plot of three additional costs, i.e., maintenance, pulling, electricity and gas costs. Maintenance and extra labor costs were placed at $50 a month, which over a seven-year-period would be $4200. Using figures for 16 five-spots already completed, the average cost per five-spot was $260 for the seven-year period. Pulling costs were computed at $90 a well with each well being pulled five times in the seven years. This gave $450 per five-spot for pulling costs.

The cost of electricity needed to lift and pressure the injected water was based on a 20-1 ratio, barrels of water to barrels of oil produced. Using a figure of 1600 barrels per acre of recoverable oil, 32,000 barrels of water per acre would be required. At a rate of ½ cent a barrel, the cost for the injection of the water would be $160 per acre of $400 per water well. The cost of gas used on the engines operating the powers computed at 50 cents per 1000 cubic feet came to $750 a well to lift the oil over the seven-year period. However, as two-thirds of the gas used could be produced from the lease, a charge of only $250 was used. The graph of electricity and gas costs is therefore not a straight line, as the number of wells



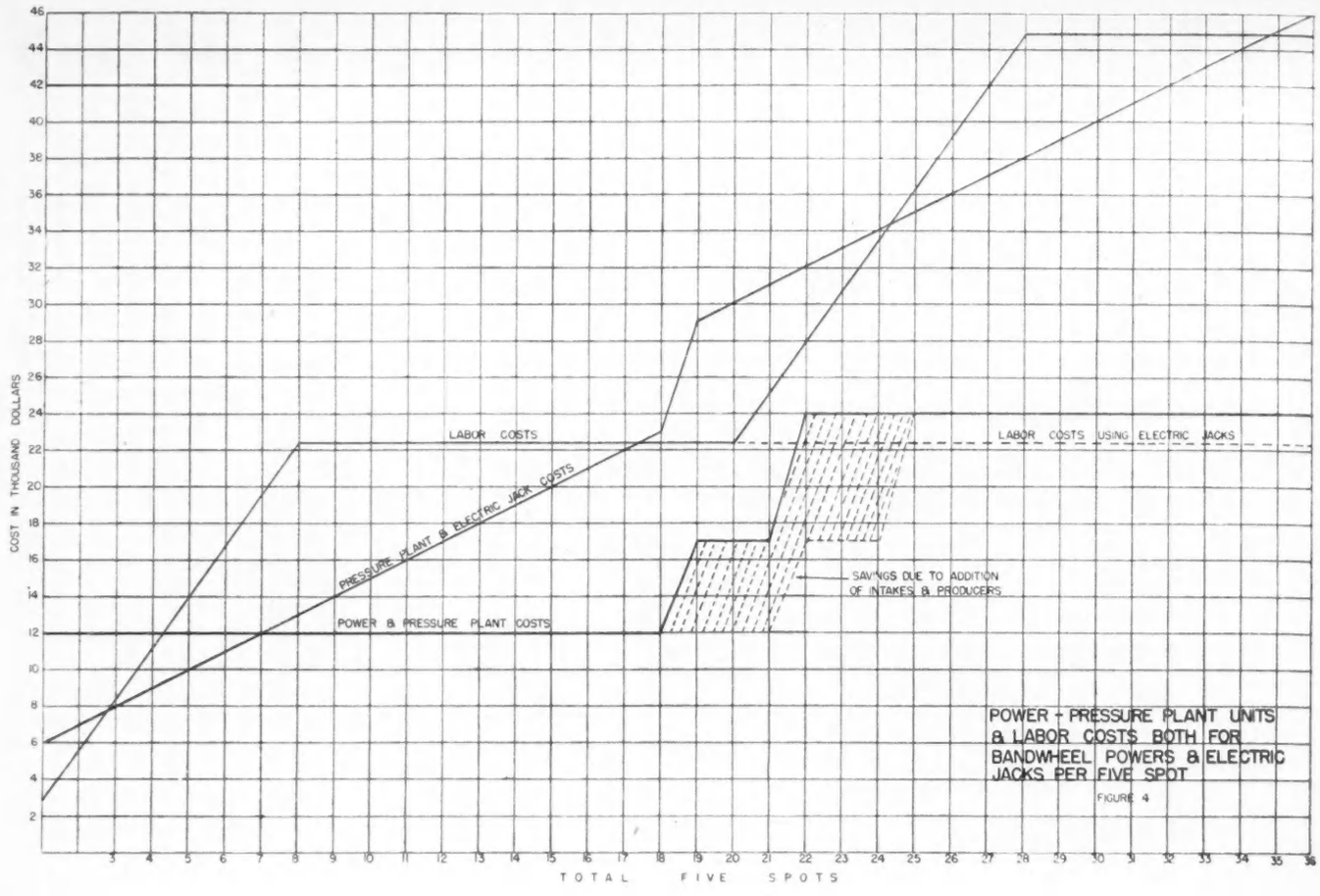


added each additional five-spot varies as the property is developed.

Figure 4 is a graph of power and pressure plant costs and labor costs. The cost assigned to a band wheel power was $7000 and to a pressure plant unit, $5000. On this particular property no charge was made for a supply-water well or turbine pump, as water was already available. Such charges would have to be included on a development in which a supply-water well did not exist. The property studied was of such size that both a power and pressure plant were installed at the beginning of the development. The cost was assigned to the first five-spot and carried through until additional pressure plant units and

TABLE 1

ITEM	Average Price/Unit	Average Amount Used	Average Price for 8 Oil Wells	Average Price 6 1½" Water Wells	Average Price 5-2" Water Wells
Drilling	$ 1.10/ft.	1792 ft.	$1,944.85	$1,944.85	$1,944.85
Clean Out	$35.00/day	22.5 days	770.26	770.26	770.26
Shoot	$ 2.32/qt.	80.3 qts.	186.56	186.56	186.56
Chip and Log			25.79	25.79	25.79
Core Analysis			80.17	80.17	80.17
Casing 6¼"	$ .38/ft.	342 ft.	129.98	129.98	129.98
Casing 8"	$ 63/ft.	43.5 ft.	27.42	27.42	27.42
Tubing 1½"	$ .069/ft.	1736 ft.		120.12	
Tubing 2"	$ .25/ft.	1707 ft.			386.35
Tubing 2"	$ .25/ft.	1757 ft.	440.31		
Rods ⅝"	$ .10/ft.	1756 ft.	176.56		
Packer				72.00	72.00
Cement		15 sacks		17.25	17.25
Plunger Barrel			36.04		
Jack and Rod Lines			200.00		
Oil and Gas Lines			150.00		
Water Lines				175.00	175.00
Meter Connection				50.00	50.00
Clearing Location:					
Timber Permit			170.83	170.83	170.83
Tankage			50.00		
Trucking			15.00	15.00	15.00
Total			$4,403.77	$3,7 5.23	$4,031.46


COST IN THOUSAND DOLLARS
TOTAL FIVE SPOTS
LABOR COSTS
LABOR COSTS USING ELECTRIC JACKS
PRESSURE PLANT & ELECTRIC JACK COSTS
POWER & PRESSURE PLANT COSTS
SAVINGS DUE TO ADDITION OF INTAKES & PRODUCERS
POWER + PRESSURE PLANT UNITS & LABOR COSTS BOTH FOR BANDWHEEL POWERS & ELECTRIC JACKS PER FIVE SPOT
FIGURE 4

powers were needed. Assuming an intake rate of 50 barrels per day, the maximum number of wells on a pressure plant with a pump capacity of 1400 barrels per day would be 28 intakes or 18 five-spots. However, it might be possible by speeding up the pump or with lower injection rates for one unit to handle up to 32 wells. If these conditions were present the cost line could be extended to 21 five-spots before additional units would have to be added. A similar thought could be used for band-wheel power costs. A total number of 21 wells, requiring 2-1/3 horsepower per well, could be carried on a 50 horsepower engine if the wells were pumping 24 hours a day. If, however, the wells do not require 24-hour pumping, then more wells could be handled by the power. For these calculations, we assumed an increase of three wells due to the change in pumping time. The dashed area between the two cost curves shows savings obtained by adding wells to the pressure plant and power units.

Labor Costs

Labor costs were computed on the hourly basis of $1.365 for a pumper. It was calculated that a pumper would need to spend one hour a day for 1 five-spot, two hours for 2 five-spots, etc., up to 8 five-spots. From that point out until a new power was installed on the 21st five-spot, the pumper could handle additional five-spot units without additional labor costs. The labor costs again rose when the second man was put on and continues to rise until he too was handling 8 five-spots. Then again an additional five-spot brings no increase in labor costs until the third man has to be added.

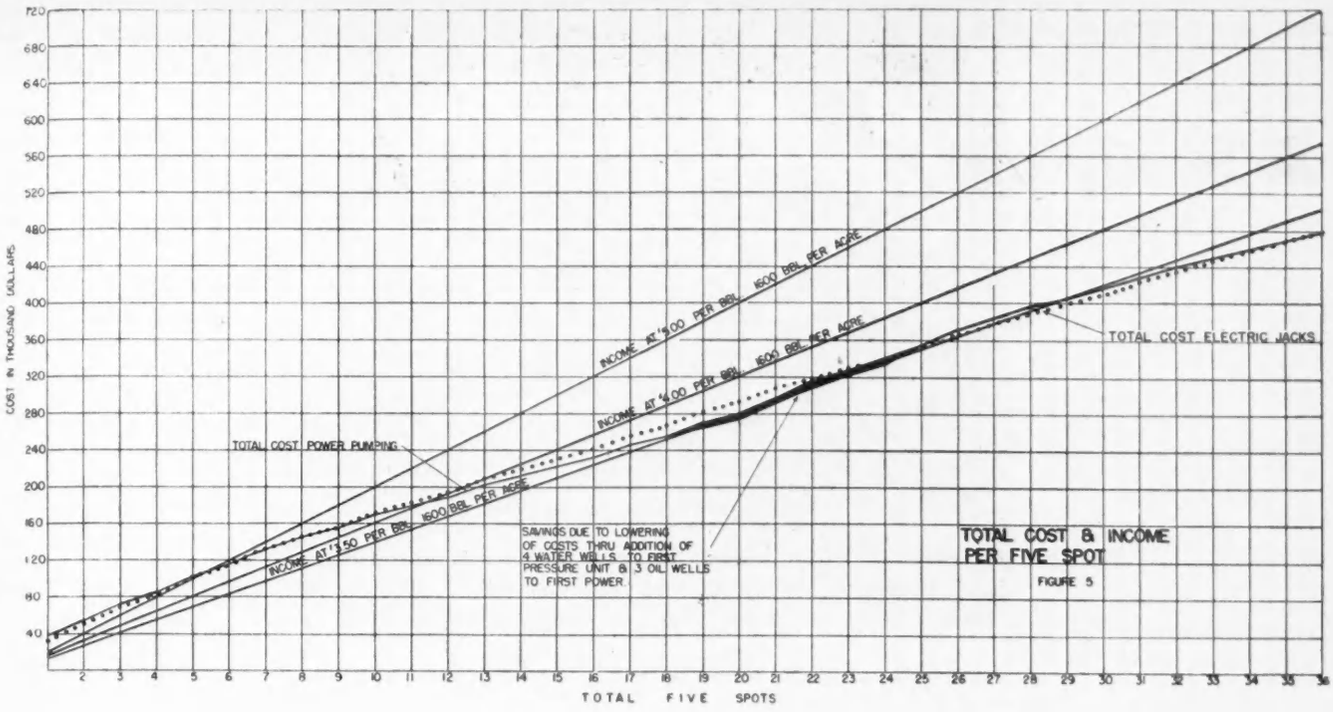
Electric Jacks

As a further study in this cost picture, calculations were made for the same property using electric jacks computed at $1000 a well installed. The graph as presented shows that one man can handle a greater number of wells using electric jacks than he could on a band-wheel power. Substantial savings on labor costs therefore could be realized. However, these savings are in a large measure nullified by the increase in cost for the installation of electric jacks. In Figure 5 the total cost line using electric jacks shows some savings by use of the jacks at a higher number of five-spots. No figure for the cost of transportation of a pumper on the electric jack operation was included. A system used in the Bradford area for one man covering 40-50 wells using electric jacks, is to provide the man with some type of transportation. When this transportation cost is added to that of the jacks the total cost picture for both kinds of powers becomes nearly the same.

The total cost per five-spot was computed from the total of all costs mentioned above. The income was derived from the expected recovery of 1600 barrels per acre. Using three different prices of oil . . . $3.50, $4 and $5 per barrel plots were made for income per five-spot. The total cost line has been changed to show a marginal area introduced by adding wells to the original pressure plant and power units. Further, a total cost line using electric jacks was plotted. As explained, the lines for the total cost using band-wheel power and electric jacks would show no saving through use of electric jacks if the cost of transportation were included.

Conclusions

From a graph such as Figure 5 an operator would be able to see the number of five-spots needed to be completed to reach a "break-even" point and the number to be drilled to realize a profit. Due to high costs of labor, power and pressure plant units on the first few five-spots, and the higher development costs on the same first five-spots, the total cost curve is not a straight line but after an original steep slope tends to flatten. This curve in conjunction with the income curves definitely show a critical area in


COST IN THOUSAND DOLLARS
TOTAL FIVE SPOTS
INCOME AT $1.00 PER BBL. 1600 BBL PER ACRE
INCOME AT $.50 PER BBL. 1600 BBL PER ACRE
INCOME AT $.50 PER BBL. 1600 BBL PER ACRE
TOTAL COST POWER PUMPING
TOTAL COST ELECTRIC JACKS
SAVINGS DUE TO LOWERING OF COSTS THRU ADDITION OF 4 WATER WELLS TO FIRST PRESSURE UNIT & 3 OIL WELLS TO FIRST POWER.
TOTAL COST & INCOME PER FIVE SPOT
FIGURE 5

which completion of several more five-spots would insure a profit whereas the stoppage of development might occur at a point at which the high original costs would be greater than the income realized.

Although the data used for this paper were based on an actual cost basis of an actual lease, it is hoped the curves in Figures 2, 3 and 4 may be applicable to any development merely by changing the scale of the cost coordinate. Since the graphs are plotted on a per five-spot basis, a conversion to per acre can easily be made regardless of well spacing. The "break-even" number of five-spots as found in Figure 5 will come from the total cost per five-spot of a lease's development plotted against income for that lease on a per five-spot basis.

ACKNOWLEDGEMENTS

The authors wish to acknowledge E. T. Heck of the Quaker State Oil Refining Corporation for his valuable suggestions in the preparation of this paper. We wish to thank the Quaker State Oil Refining Corporation for permission to publish the data used in this paper.

Chemical Removal of Aluminum Pipe Sections

■ CONTINUED FROM PAGE 133

removing. This will aid in cleaning out the hole.

The volume of ammonia generated may have to be taken into consideration where the aluminum section is much over 100 feet. This will amount to about 5.7 cubic feet for each pound of aluminum dissolved by the reaction. If the ammonia coming from the well causes no inconvenience to nearby residents, no harm will be done. However, with the amount generated per batch with several hundred feet of liner, considerable gas may be liberated in the pit when the solution is circulated out. The following examples show the amount of ammonia gas formed with increasing lengths of aluminum pipe:

Ammonia generated from pipe

Length of 5½" Liner	Lbs. Al per Batch	NH_3 In Cu. Ft./ Batch @ 68° F.
100'.....	136	776
500'.....	680	3880
1000'.....	1360	7760
1500'.....	2040	11,640

The chemical solutions as made up will average about 10.9 pounds per gallon in weight. If reacted without dilution they will approximate 13.0 pounds per gallon when entirely spent. The end products are completely soluble and there is no chance of a thick gummy mass that cannot be bailed or circulated out.

Gas Wells or Gas Pays

Sometimes a window is placed opposite a gas pay above an oil pay which is to be abandoned. The well is usually plugged back and can be bailed dry. Tubing is run and a cross-connection made between the tubing and casing at the top of the well. If the first batch does not break through and allow gas pressure, it must be swabbed out. In most cases, it should be found that if a batch and a half in volume is used the first time, the gas will break through. The tubing and well should be closed in during the reaction. With the tubing clear to bottom, the top valve can then be opened and the reacted solution blown out.

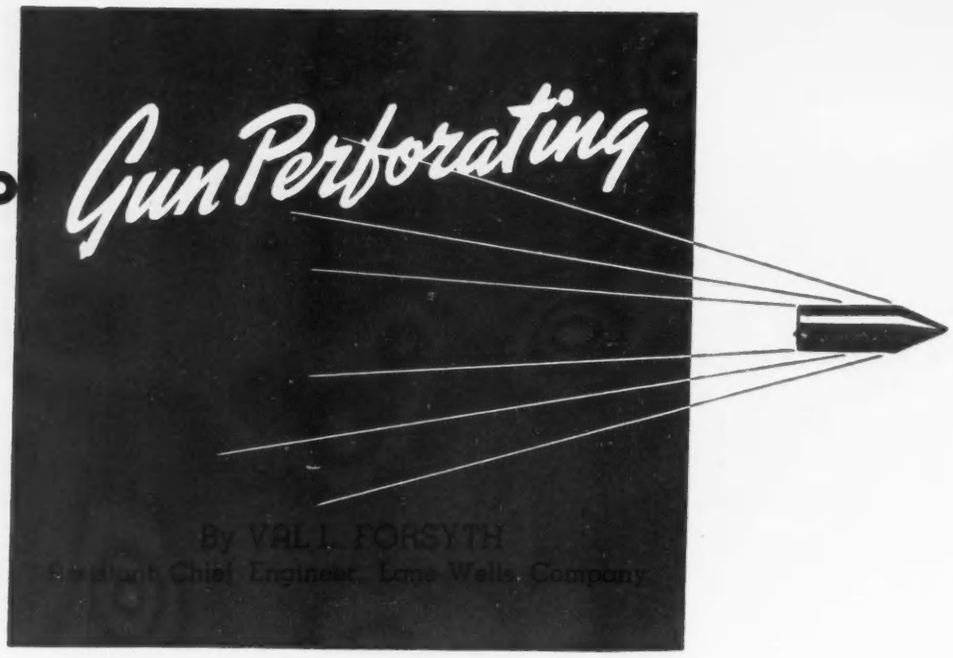
The next batches are placed in the tubing by the pump and then pressure through the cross-connection to the casing is applied, allowing the solution to lubricate to bottom. Fluids are then blown out again after their reactions. Suitable connections should be made to direct the blowing in a desired direction to prevent harm.

By proper use of gypsum cement and a limit plug set just below an aluminum section, it is possible to segregate more than one window and selectively remove it. The lowest window can be worked on first.

We Fumbled!

The article, "Production of Crude Oil by Solution in High-Pressure Water," beginning on Page 136 of our September number was written by Harry M. Ryder, author of a number of articles recently in the magazine. The by-line was left off and the omission went undetected through various proofreadings which followed. Our apologies to the writer and the hope that this will in some measure serve to identify him as the author of the most interesting article.

A Study of Gun Perforating



By VAL L. FORSYTH
Consultant Chief Engineer, Lane-Wells Company

(Conclusion)

Part 3— Gun Perforator Penetration

A NECESSARY part of planning a completion program is a working knowledge of just what can be expected from equipment involved in the completion operation. It is said that a well-planned program is usually a compromise arrangement representing concessions as to casing size, weight and type; drilled hole size; cementing practices; gun perforating equipment; a host of similar factors; and, of course, the controlling factor—economics. The following information is presented in the interest of providing accurate data regarding the variable factor of gun perforating equipment.

A large part of the pertinent data herein has been accumulated as a result of mutually conducted tests with the research laboratories of one of the major oil companies. To the engineers and technicians of this company, who have contributed so much to the over-all problems, sincere appreciation is expressed.

Explanation of Test Conditions

Tests were conducted under both surface and subsurface conditions. In the subsurface tests a joint of 5-inch 18 pound J-55 casing was centered and cemented inside 7-inch 28 pound N-80 casing. The test specimen was run on a string of 5½-inch casing to a depth of approximately 6500 feet under 10 pound/gallon mud. Bottom hole temperature readings were taken at intervals to judge the temperature-time relationship. The oil company personnel were able to determine accurately the strength of the subsurface neat cement at the time it was perforated. Testing operations continued over a period of several days and the results obtained were correlated with similar tests at the surface.

Surface tests were conducted with a standard test barrel, shown in Figure 1. (A standard barrel consists of a section of casing set inside a very thin, eight-inch, sheet metal form representing the bore hole). The formations surrounding the well bore were of two types:

(a) Concrete—consisting of an aggregate of one part high early strength cement and two parts washed river sand, with a compressive strength above 5000 psi and a tensile of approximately 485 psi. This was utilized to represent very dense limestone or sandstone.

(b) Loose sand, composed entirely of river sand washed and tamped into place. This was utilized to represent very unconsolidated formation.

Other surface tests were made with 5-inch, 18-pound J-55 casing cemented inside 7-inch, 28-pound N-80 casing. These samples were identical with those used in subsurface work and presented

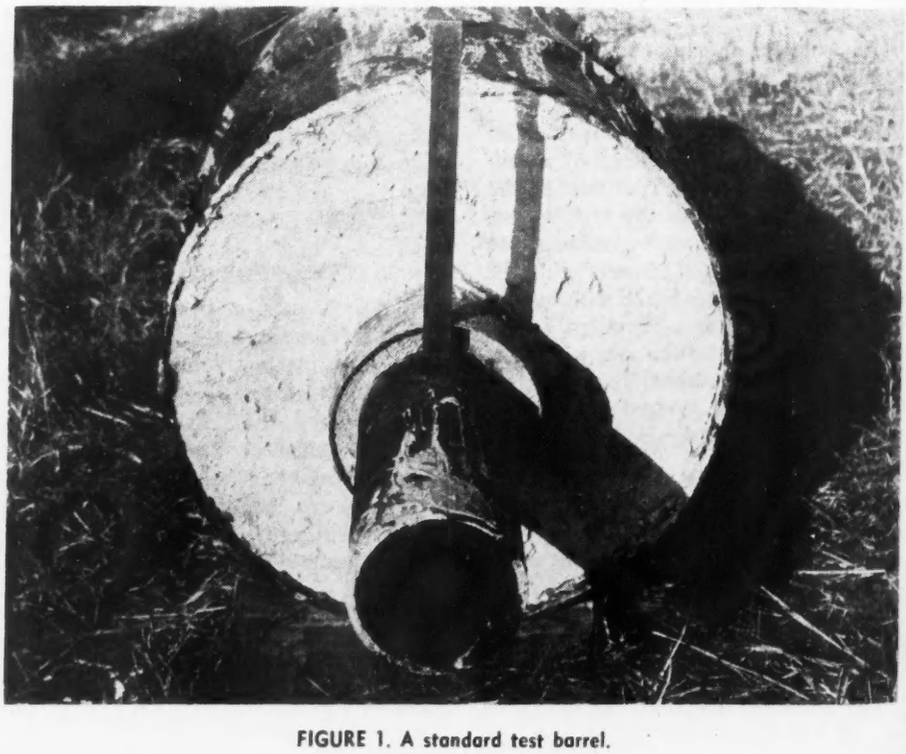


FIGURE 1. A standard test barrel.

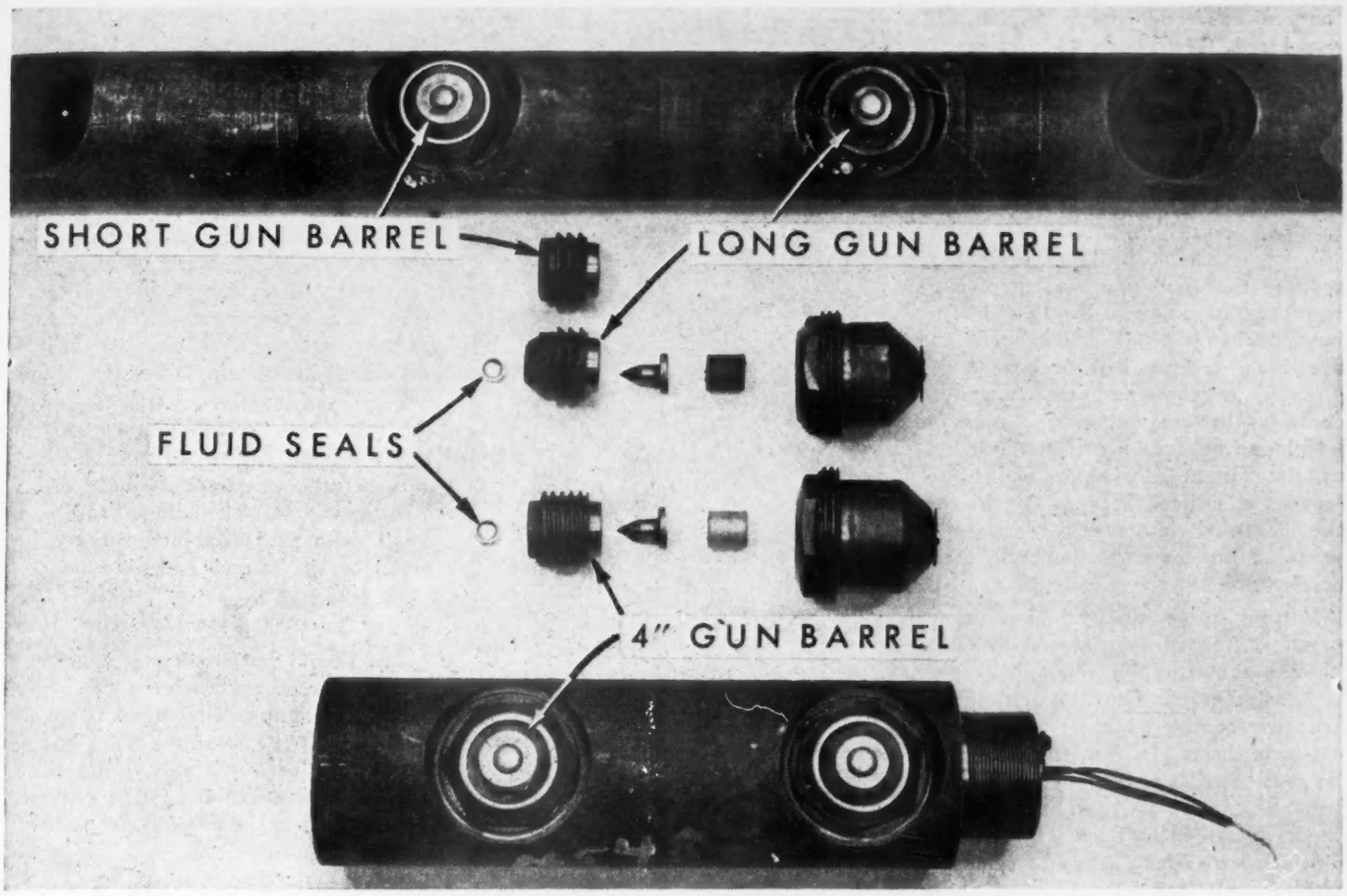


FIGURE 2. Details of gun assembly.

opportunity for comparison of results.

For the purpose of this discussion, penetration is measured from the inner wall of the casing to the deepest point of penetration of the bullet point.

Gun perforator equipment used by the service company included the following gun and bullet combinations:

(a) 3⅝-inch gun, ⅜-inch and 15/32-inch bullets.

(b) 4-inch gun, 15/32-inch bullets.

(c) 4⅛-inch gun, ⅜-inch and 15/32-inch bullets (3⅝-inch gun with long barrels).

All guns were a selectively fired type. Numerous tests were made utilizing various combinations of jacketed bullets, powder charges, bullet shapes, and shear discs.

Discussion of Results

In discussing penetration, all statements should be carefully qualified because there are so many variables, any one of which can influence the gun performance. For example, good operating practice permits the use of two gun sizes in 5-inch casing, the 4-inch and the 3⅝-inch. Use of the 4-inch gun results in maximum penetration. But, by reason of reduced clearance between casing and gun, running speed is reduced and there is a greater chance of sticking the gun.

The 3⅝-inch gun, on the other hand, satisfies problems of running speed and clearance. Because of reduced diameter, it is capable of less penetration. Where a single string and a normal amount of cement are encountered, the 3⅝-inch gun has been used for years with success. In some guns, lengthened barrels may be used for larger casing sizes. Figure 2 illustrates how the 3⅝-inch gun diameter is increased to 4⅛-inch. Penetration is stepped up considerably by this means.

Subsurface penetration tests were conducted with two strings of casing; 5-inch and 7-inch. Because of the test conditions, results of these tests were either positive or negative; i.e., the bullet either penetrated or it did not penetrate. There was no opportunity to measure penetration beyond the second string.

The 3⅝-inch gun utilizing the standard powder charges and 15/32-inch bullets usually stuck only the nose of the bullets through the second string, although in some instances bullets passed entirely through the second string. (5-inch, 18-pound J-55 cemented inside 7-inch, 28-pound N-80). Using the longer gun barrels, however, two-string penetration was accomplished consistently. Although the 4-inch gun was not used in these tests, its penetrating ability is known to approximate the 3⅝-inch gun with long barrels. (4⅛-inch gun). Two-string penetration with the 4-inch gun has been obtained in numerous other tests.

To properly review this analysis it must be realized that the neat cement was extremely hard and the penetration assignment a most difficult one.

Depth of penetration through casing, cement, and on into the formation is most difficult to discuss in a few words. Penetration is dependent upon forces restricting movement of the bullet, such as casing type and weight, cement strength and thickness, and formation type and strength.

Penetration with the 4-inch and 4⅛-inch guns through 5½-inch, 17-pound J-55 casing was approximately 6 inches for one shot in a standard test barrel. (See Figure 1).

Penetration up to 4 inches through 5½-inch, 17-pound J-55 casing was secured with the 3⅝-inch gun firing one shot in the standard barrel. In similar tests, penetration was increased to 8 inches where each following shot receives the cracking benefits of the preceding shot. (Six shots per foot).

Single-string completions are usually routine jobs for the gun perforator.

Surface tests conducted in the standard test barrel (see Figure 1) present excellent material for this study. In this work it was possible to gauge the effect of changing various components of the gun. The results are discussed below.

Gun Size

As gun size (outside diameter) is reduced there is usually a corresponding reduction in barrel length and combustion chamber wall thickness. These are both critical dimensions. The strength of the combustion chamber controls the amount of gas pressure which can be developed and the length of time it can be held. The barrel length is critical because it controls the length of time that the expanding gases can act upon the bullet to cause acceleration.

Putting these thoughts into more practical form permits correlating this knowledge with the operator's completion program. The 3⅝-inch gun is the size considered most practical in 4¾-inch casing. Its penetration should be considered as limited to single-string work unless two fairly light strings are used. A 4¾-inch liner cemented in 6⅝-inch or 7-inch casing, cemented inside an 8⅝-inch hole, becomes a real problem. Where circumstances of this nature are encountered the conditions should be thoroughly discussed with the service company.

The 4-inch gun is usually considered for use in 5½-inch casing although in an emergency it is used in some weights of 5 inches. This gun is capable of two-string penetration.

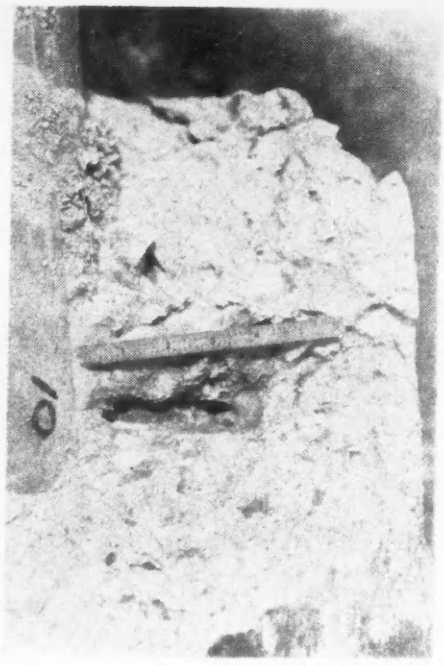


FIGURE 3. Example of bullet tumbling—away from camera.

Bullet Size

In some areas, producing problems may call for 1/16-inch, ⅛-inch, ¼-inch, ⅜-inch, 15/32-inch or 9/16-inch bullets. If such requirements are encountered it is the service company's responsibility to be able to satisfy the need with minimum change in penetrating ability.

With each type of gun design a combination of factors influence penetration characteristics. For instance, a gun which utilizes no shear disc, and practically no powder compaction, may provide best results with a small diameter lightweight bullet; while another gun utilizing a closed combustion chamber, a shear disc and a high degree of powder compaction may secure best results with a 15-32-inch bullet; or a third design, utilizing a heavy shear disc, medium powder compaction and a gas escape in the combustion chamber, may give best results with some other size bullet.

The point of interest is that each gun type may have a different best size of bullet. In the gun tested the difference in penetration between ⅜-inch, 15/32-inch and 9/16-inch bullets was very small, with the 15/32-inch slightly superior to the ⅜-inch and 9/16-inch.

Burr Free Caps

The use of burr-removing caps over bullets has been considered for years, as explained by Turechek[1]. The desirability of a burr-free hole in the casing has been recognized. Farris & Oliphant[2] have explained that burr removal is not now possible without sacrifice in penetration.

This reduction in penetration can be as much as 25 percent, dependent upon the test conditions. Caps over bullets also increase the tumbling effect with resultant loss of penetration and, of course, cause a portion of the available energy to be devoted to burr removal at the sacrifice of bullet penetration.

There have been reports of the armed forces utilizing caps over bullet points to lubricate the bullet through armor. Investigation has revealed the following:

1. The ogival shaped bullet nose is recognized as the strongest type of point for armor work. When point breakage occurs, a bullet either ricochets or tumbles, with poor penetration the result; hence conical bullets are not usually used. In military ballistics flight characteristics in air below or above the speed of sound are quite important. Unfortunately, the ogival shaped nose is not ideally streamlined for this requirement and has poor flight characteristics in air. Therefore, to maintain a strong bullet nose, and yet streamline it for good flight characteristics, a soft cover or cap is sometimes molded over the projectile nose for ordnance work.

2. This soft cap over the nose of military projectiles satisfies another problem. Bullets striking armor plate at an angle have a tendency to ricochet. The soft cap, by striking the surface first, creates a tendency for the bullet to align itself more properly with the

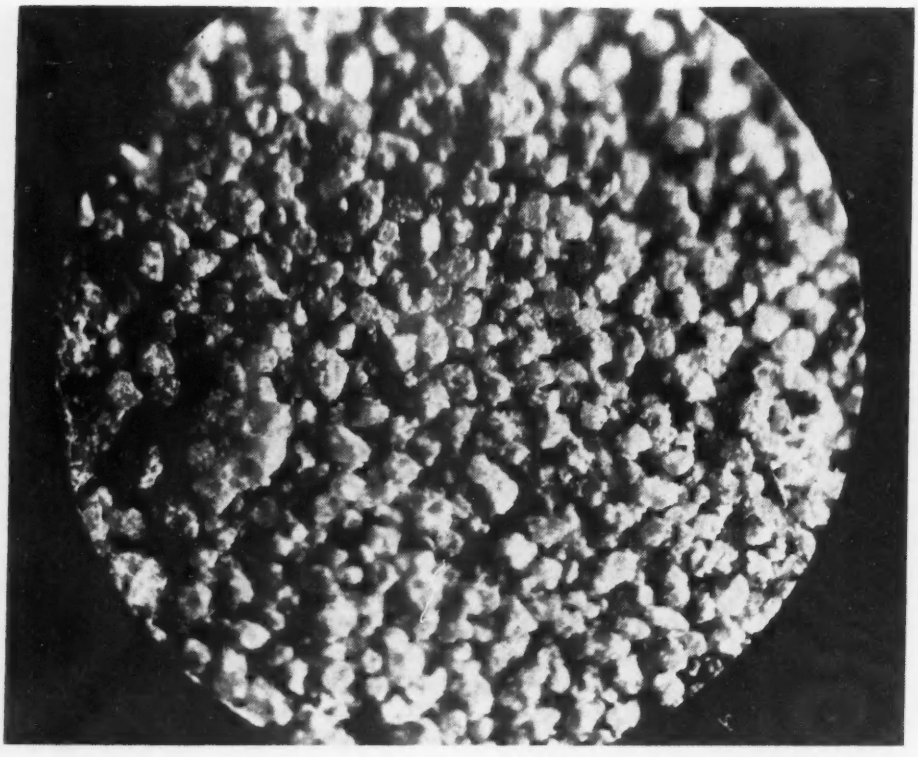
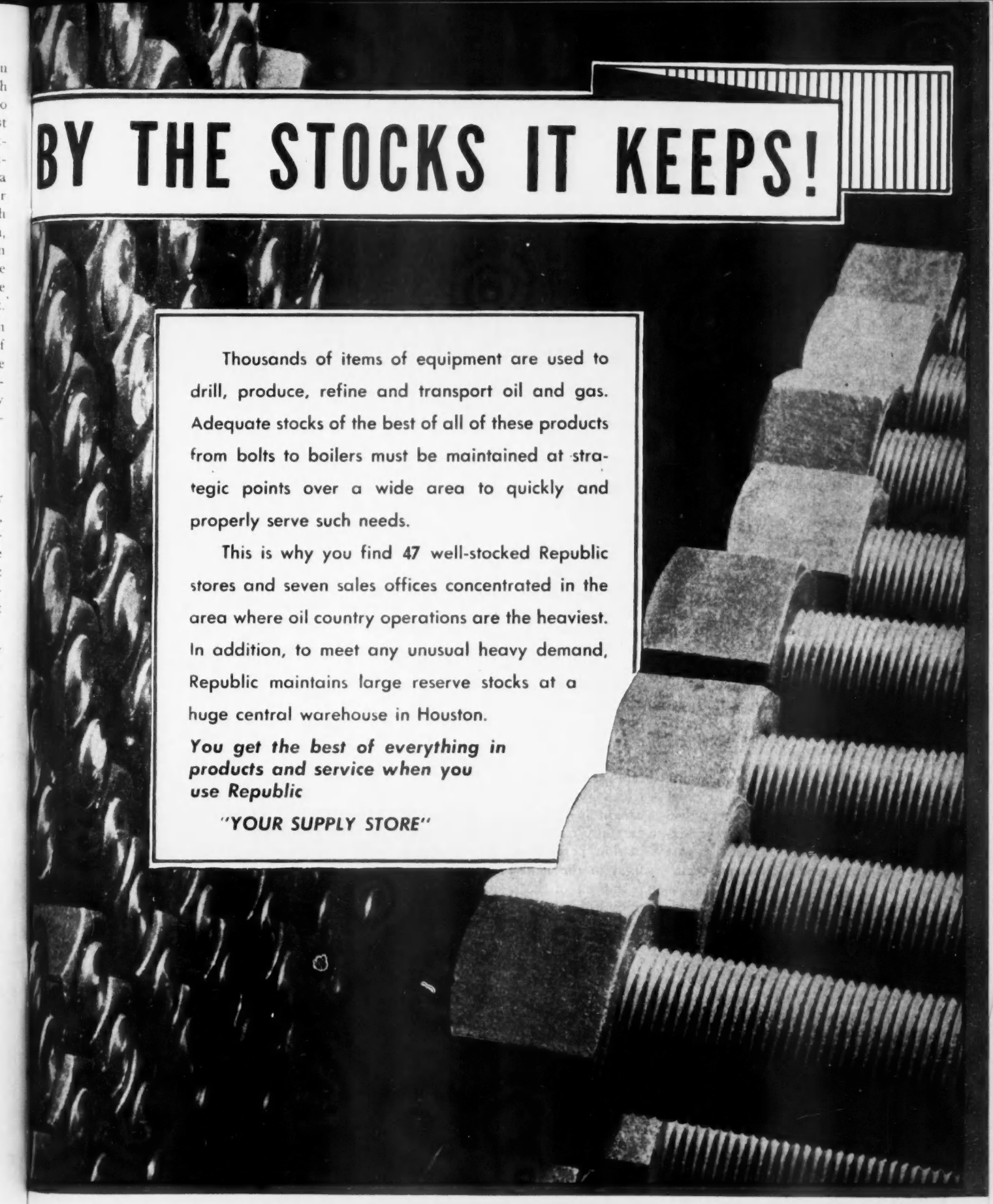


FIGURE 4. Microscopic photographs of formation samples recovered from gun perforators.



BY THE STOCKS IT KEEPS!

Thousands of items of equipment are used to drill, produce, refine and transport oil and gas. Adequate stocks of the best of all of these products from bolts to boilers must be maintained at strategic points over a wide area to quickly and properly serve such needs.

This is why you find 47 well-stocked Republic stores and seven sales offices concentrated in the area where oil country operations are the heaviest. In addition, to meet any unusual heavy demand, Republic maintains large reserve stocks at a huge central warehouse in Houston.

You get the best of everything in products and service when you use Republic

"YOUR SUPPLY STORE"

Republic Supply COMPANY

GENERAL OFFICES · · · HOUSTON 1, TEXAS

FIGURE 5. Bullet return, observed during surface test.

face of the armor and thereby improves the average penetrating ability.

There has been considerable study given to the proper shape of a gun perforator bullet nose. Most service companies now use the ogival shape. Reasons for its use are as follows:

1. If a gun perforator bullet begins to tumble soon after or during its passage through casing, its depth of penetration will be materially affected. The ogival nose bullet has a maximum mass of material forward; thus its center of gravity is further forward. It is believed that this reduces tumbling tendencies.

2. When bullet point breakage occurs, ricochet and tumbling result. The point structure is strongest with the ogival nose. Bullet breakage is rarely experienced today, whereas in the past such breakage was a frequent occurrence.

3. A properly designed ogival nose takes into account the mass of material which the bullet is called upon to move during its passage through a casing wall.

As the bullet enters casing, metal which forms the burr takes the path of least resistance and first extends inward along the bullet point. As bullet penetration becomes greater, the burr folds over to form a small bead. It is this ability to form a burr with the sharp edges rolled over which characterizes the ogival bullet.

Tumbling

There are several things which definitely affect tumbling.

1. Where unusual bullet sizes (such as ¼-inch or ⅜-inch) have been required, it has sometimes been necessary to use jacketed bullets. A jacketed bullet is one which has been covered with a sleeve to make possible its use in larger bore barrels. Such jackets sometimes result in bullets beginning their tumble before leaving the barrel bore, with the result that they strike the casing at a greater angle than bullets fired from guns of such size as to be matched properly to the casing. The use of jacketed bullets will not usually be necessary if the service company is given sufficient advance notice of unusual bullet size requirements.

2. A small gun run inside large casing presents possibility of a poor angle of attack of bullet to casing wall. While ricochet does not occur this does result in tumbling. A gun, properly matched to the casing should have clearance for nominal operating speeds and to provide passage for foreign material, yet should be as large as possible to provide full penetration and good burr characteristics.

Bullet Bounceback

In any discussion of penetration there always appears the question, "Why do operators bail bullets from wells?" This question cannot be answered until it is determined whether or not the bullets have penetrated through the casing. Although it is true that there have been instances where gun perforator bullets failed to penetrate casing, it is equally true that there have been instances where well conditions were responsible for bullet recovery.

In many instances, and particularly in dry holes, some gun perforators retain samples of the formation penetrated by the bullet. These particles are caught in the powder recess and when carefully examined reflect the type formation perforated. This evidence was used in the field to verify early interpretations of the radioactivity well logs. (See Figure 4).

Bullet Recovery

This phenomenon, which frequently results in recovery of cement and formation particles, occasionally results in bullet recovery. Drawing or pulling tendencies are sometimes quite vigorous and indicate the occasional presence of considerable force.

It has been the writer's experience that some bullets return to the gun with the point in the reversed position and with samples of the formation lodged in the powder recess ahead of the bullet. Figures 5 and 6 illustrate those instances where bullet return to casing occurred in surface test work with the oil company personnel present. The bullet shown in Figure 5 is so tightly lodged in the casing that without special tools for the purpose it could not be pushed from place; and it is pointed in the opposite direction

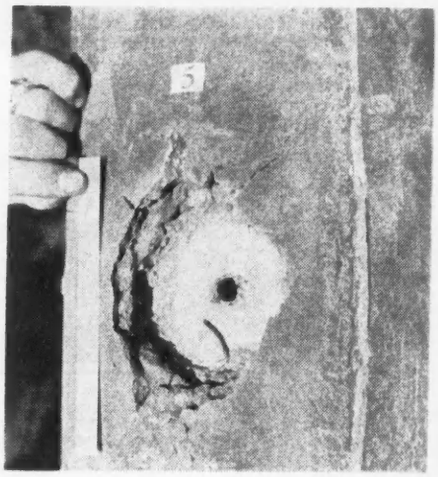


FIGURE 6. Bullet return, observed during surface test.

to that followed when it made the hole in the casing, cement, and formation.

These facts are not presented here as an explanation for all bullet recovery, but they do assist in explaining why some recovered bullets show evidence of formation marking even though they may be recovered from inside the casing.

A Study of Bullet Marking

When bullets are recovered from a well after a perforating job, one of two things has occurred. Either the bullets failed to penetrate the casing, or they penetrated through the casing and then returned to the well bore. Fortunately there is tell-tale evidence present in every instance which will actually indicate whether or not the bullet penetrated casing, cement and formation. (See Figure 7.)

A new bullet carries lathe markings as a result of the manufacturing technique used in its construction. These marks are perpendicular to the axis of the bullet. Shooting the bullet into wood does not materially change these markings (Figure 7). Perforating a solid steel bar only polishes the nose of the bullet by smoothing off the ridges.

Cement and drilling mud usually contain a very small quantity of extremely fine sand particles. When the nose of a bullet traveling at great speed encounters these particles, which are harder than the bullet steel, it is noticably marked. If the formation is sandstone or chert, or contains particles of similar hard material, the bullet nose is marked even more severely than with cement or mud (Figure 7).

Limestone does not cause as extensive marking as sandstone or chert. With limestone the bullet is marked primarily by the cement and mud cake it penetrates.

Bullets frequently tumble at least a

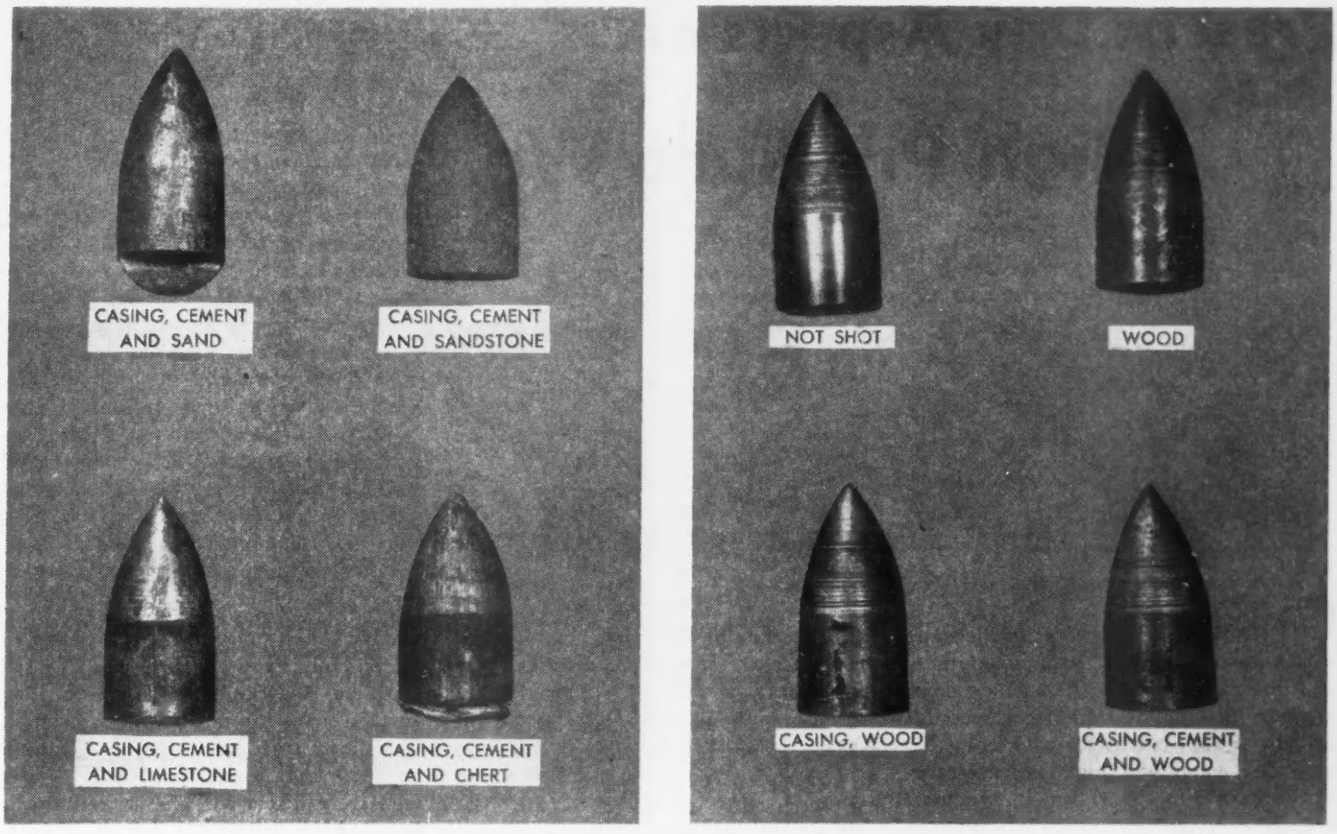


FIGURE 7. A study of bullet striations and effect of formation composition.

part of one revolution and sometimes more than one revolution. If the arc of tumbling is quite small, only one side of the nose may be marked while the other side will be unmarked.

Discussion of Results

There have been instances where large quantities of marked bullets were recovered from wells. In such cases extreme care must be exercised in treating the well because the casing may be so badly eroded that the gas blast from each shot may blow a large hole in the casing.

Where more than 2 percent of the bullets fired are recovered from the well bore, the matter should be investigated. The 2 percent figure is an arbitrary one subject to experience and opinion. The important points the writer wishes to make are as follows:

1. If the bullets show formation markings, the casing condition may not permit further perforating, the use of packers, squeeze operations, and the like.

2. If the bullets do not bear cement or formation markings, the service company should be acquainted with the circumstances immediately.

There have been instances where, after a well has been perforated, the testing operations indicate an absence of fluid from a zone previously considered productive. Among other things this might be a result of poor penetration or of inaccuracies in well depth measurements. If recovered bullets have striations indicative of cement penetration, the evidence points either to inaccuracy in measurements or to a need for increased shot density.

Inferior Gun Performance

Despite the fact that design features have made provision against poor penetration, there are certain things which can affect the performance of any gun perforator.

(a) Barrel wear is a contributing factor to poor gun performance. As much as 25 percent penetration loss can result from oversize barrels in some guns, while in other guns' designs this is even more critical.

(b) Inefficiencies in manufacture result in poor products being used in the gun. Powder troubles, bullet steel problems, and many other factors must be watched with continued alertness.

(c) Inefficiencies in handling equipment in the field can result in faulty equipment performance. Personnel must be carefully trained and adequately supplied with standardized instructions for inspecting, gauging, cleaning and loading gun perforation equipment. Supervision must be alert and well-informed of the operational requirements. There must be a continuous flow of expendables, tools, accessories, and instructions.

(d) Fluid seals must be designed and maintained for faultless performance. The one factor most directly responsible for poor gun operation is poor fluid seal performance. A drop of water in the powder recess becomes steam under subsurface conditions. Steam will permeate the powder recess and very seriously affect penetration by slowing the burning rate.

Recommended Procedures for Better Service

While it is known that many operators have worked out practices which will satisfy their individual problems better than those the service company has to offer, it is believed that a consideration of and adherence to the following suggestions will permit the service company to render a better service.

(a) Call in the job as far in advance as possible. This permits assembling special equipment, if it is required.

(b) Explain the details of the completion to a qualified service company representative.

(c) Give all the facts of well conditions at the time of calling in a job.

BIBLIOGRAPHY

Turechek, George F., Burr Characteristics of Gun Perforated Casing. Tomorrow's Tools Today! Vol. XII, No. 1, 1st. Quarter, 1947.

Oliphant, S. C., and Farris, R. F., A Study of Some Factors Affecting Gun Perforating. Paper presented to American Institute of Mining and Metallurgical Engineers, Petroleum Division, Galveston, Texas, October 4, 1946.

Present Day Aspects of High Pressure Well *Equipment Corrosion*

By W. F. ROGERS
Chemical Engineer, Gulf Oil Corporation

CORROSION losses of condensate well equipment are of such magnitude as to be an appreciable item of expense in many fields. These high costs result both from high corrosion rates from the produced water and high expenses for working over wells when it becomes necessary to replace corroded subsurface equipment.

Condensate wells are but recent additions to the oil producing business and they have brought numerous individual characteristics not associated with crude oil wells. Briefly, those characteristics which indicate a condensate well to the petroleum engineer are given below.

1. Production obtained at high gas oil ratios. The average values range from 66,000 to 20,000 cubic feet per barrel of liquid (15 to 50 barrels of liquid per million cubic feet of gas).

2. The produced liquid is normally water-white to straw colored although fringe oil production may result in a darker product.

3. Well depths range from 7000 feet down to the deepest producers.

4. High top-hole pressures result from low to no fluid level in the hole.

Many condensate reservoirs contain only the hydrocarbons in the single phase state subject to retrograde condensate phenomena. Some such reservoirs have no edge oil band while others have oil bands varying from small to large in comparison with the volume of the condensate portion. Broadly speaking, condensate reservoirs contain a wide variety of hydrocarbon mixtures and vary widely with respect to richness and quantity of recoverable liquid.

To the corrosion engineer other properties characterize the condensate well. Thee are:

1. Presence of organic acids (acetic-propionic types). The concentrations vary from 50 to 1500 parts per million.

2. Presence of acid well head waters. pH values at the well head range from 4.0 to 6.0.

3. Presence of appreciable carbon dioxide pressures. This ranges from 0.20 to 4.50 mol percent and from 10 to 50 psi pressure in the well gas.

STUDIES SUMMARIZING experience with condensate well corrosion indicate means and methods whereby serious losses can be averted if not entirely eliminated and costly down time or complete well loss thereby avoided.

4. Relatively low salinity of produced water. The total dissolved solids usually range up to about 2000 parts per million although in some cases the salinities of bottom-hole waters are approached.

5. Production of small amounts of water, i.e., from traces to five to ten barrels daily.

6. The aqueous fluid usually contains up to 400 parts per million iron as a result of subsurface corrosion phenomena.

Using these approximate criteria there are approximately 85 condensate fields in Texas, Louisiana, Arkansas, and Mississippi. These do not constitute a complete list as new fields are being constantly added. The majority of condensate fields in the U. S. are in the territory listed. Outside of this area there are about two condensate fields in each of the states of California, Colorado, Kansas, and Oklahoma.

History of the Condensate Corrosion Problem

The condensate well corrosion problem was first discussed in a paper by Bacon and Brown before the Natural Gasoline Association in April of 1943. In this paper the results of corrosion of Christmas tree and well head fittings in the Opelika, Anderson County, Texas, field were disclosed. The seriousness of the problem lay in the following facts.

1. It was totally unexpected.

2. It was very rapid.

3. Corrosion of well head equipment resulting in a wild well could result in the loss of thousands of dollars and serious damage to the entire reservoir.

After this date it was discovered that corrosion of a serious nature was being experienced in other fields of this type. The most rapid corrosion and greatest expense to date has been in the fields of Cotton Valley, La.; Katy, Texas; Erath, La.; Sheridan, Texas; and Old Ocean, Texas.

Many other fields are suffering financial loss from corrosion attack. The extent to which such corrosion is occurring was shown in a questionnaire circulated by the Corrosion Research Project Committee of the NGAA in 1945 and by the API Southwestern District Topical Committee on Materials in 1946. These questionnaires showed that of 93 fields reported at the time 60 percent were definitely suffering from corrosion. Of the remaining 40 percent no information was available because of the small production taken from the fields. Undoubtedly many will be found to be corrosive when they produce water. No costs on corrosion were given at the time, as these questionnaires were circulated for the main purpose of establishing the extent of the trouble.

The causes of the corrosion which occurs are well understood in a general manner although many details are yet

to be established. Basically the attack is due to the bathing of the well metal equipment by the acid, saline waters produced. The attack is further promoted by the temperature of the acid water which probably averages as high as 130° F. top-hole temperature. Another factor leading to high corrosion rates is the lack of protection afforded by the liquid hydrocarbons produced. It has been found that condensate hydrocarbons do not preferentially wet steel tubing but allow the produced water to do so. In this respect the condensate is different from many crude oil wells where the oil wets and protects the subsurface equipment from corroding. While factors such as acidity, temperature, salinity, and lack of wettability are known to enter into the corrosion rates obtained, the function of each has not been evaluated exactly. Gas velocities are also known to influence the corrosion rate and specific data have been obtained on this point. Figure 1 has been taken from published data to illustrate this. The data show that the corrosion rate is a direct function of the well production rate. This curve illustrates the fact that a well producing one million cubic feet of gas per day might be non-corrosive but would be corrosive at 5 million feet per day. In addition, a well producing through two-inch tubing might be corrosive but non-corrosive if produced through 2½- or 3-inch tubing. While the gas production of wells cannot be kept low simply to prevent corrosion the relation shown by Figure 1 should always be kept in mind. Figure 2 shows the badly corroded bore of a cast steel plug valve and Figure 3 shows the typical corroded appearance of the flange face of the same valve in condensate well service.

Inasmuch as the principal cause of

FIGURE 2. Bore of 0.45 carbon cast steel valve plug corroded by condensate well fluid.

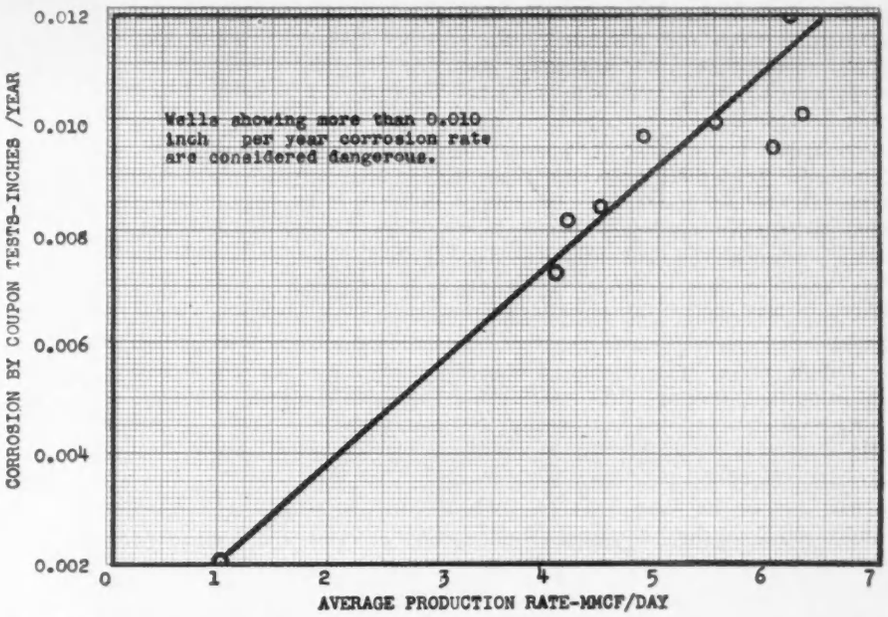


FIGURE 1. Effect of well production rate on corrosion. (Data by R. L. Hock, Cotton Valley Operators Committee.)

the corrosion has been stated as due to acid water an obvious solution would be the use of alkaline treating agents and such treatments will be discussed later.

Methods for Determining Corrosion Rates

The question may well be asked, "Having a condensate well, how does one know whether corrosion is occurring?" During the early stages of the condensate well corrosion problem this was a good question as the answer was not readily apparent. The experience of the oil business until this time was that flowing wells were not subject to corrosion. Corrosion problems primarily occurred only to pumping wells producing large quantities of water. Any corrosion which occurs to such a well becomes readily apparent because a broken rod or penetration of the tubing causes the well to go off production. Flowing wells and particularly high pressure wells do not, however, give any indication of corrosion until a leak occurs, at which time the damage may be extensive. In general, there are now four methods available for determining the severity of the corrosion attack. These methods vary from those merely giving indications of the corrosion to those showing exact conditions. In order of increasing accuracy, they are iron content of produced water, well head coupon tests, tubing caliper surveys, and visual inspection.

Determination of the iron content of a produced water shows whether corrosion is occurring but does not show the exact rate. If the iron content falls in the range of 100 to 400 ppm the fluid is almost certainly corrosive. This method of determining corrosion has the advantage of being rapid but the services of a laboratory are necessary.

Well head coupons may be used to determine whether the well fluids are corrosive but the actual rates obtained are not applicable to the subsurface equipment. Well head coupon testing has been used primarily as a means of studying rates of corrosion, types of corrosion products formed and as a means of studying sets of metals in a search for corrosion resistant materials. The method is not now recommended as a means for determining exact well corrosion rates.

Visual inspection is the best method for determining the actual condition of well equipment although the method is

FIGURE 3. Flange face of cast steel valve body corroded by condensate well fluid.

limited almost exclusively to inspecting Christmas trees and associated fittings. Prior to the time when subsurface surveys were available and particularly before corrosion resistant Christmas trees were on the market, it was necessary to dismantle Christmas trees at frequent intervals to determine their condition and to replace necessary parts. Now that corrosion resistant master valves are available this is not necessary as there is less danger of a well getting away.

Tubing survey instruments have been an important development in permitting information to be obtained on the condition of pipe below the surface of the ground. Prior to the development of these instruments there was no way, short of killing the well and pulling the tubing, to know whether the tubing was in good condition or seriously corroded. Such a situation was unsatisfactory, to say the least, as it prevented operators from knowing the condition of the well equipment until the tubing developed a leak or parted. Figure 4 shows the construction of one of these survey tools. It is run into the well on a wire line under well pressure. After reaching the desired level, the instrument is pulled upwards. In so doing the power wheel rolls in proportion to the distance traveled and rotates in a thread like manner a cylinder containing a scribable chart. At the upper end of the tool are feeler wheels. If any of these wheels enters a pit it causes a stylus to move a proportionate distance scribing a mark on the chart. The depth of the mark can be interpreted in inches. Figure 5 shows the correlation found between one of these surveys and actual pit depths determined on three joints of tubing which were split open after being surveyed in the well. It will be noted that the tubing survey fails to show the pits as deep as actually present. Thus the tubing in a well can be expected to be in worse condition than shown by this type of caliper survey. Despite this drawback such tools are very useful and their use is recommended.

Costs of Condensate Well Corrosion

The costs incurred by corrosion of condensate wells are such as to warrant efforts to reduce them. Until recently, while it was recognized from individual instances that these corrosion costs were high, no data were available to show the average magnitude of the problem. Through the efforts of research groups some data have been obtained and it is possible to approximate the cost to several companies.

One of the first companies to report did so on a large field in southern Louisiana. This field was discovered in April, 1944. By January 1, 1946, corrosion of the tubing was so severe that a general well reconditioning was required for the field. This reconditioning was accelerated by the fact that it had just been discovered that sodium chromate treatment could be used for corrosion control and it was desired to put this treatment into effect. The wells were originally equipped with three-inch tubing packed off against seven-inch casing, the annular space being filled with mud. The recompletion program consisted of installing 3½-inch gravel packed strainer through the producing formation with packer and lead seal on top. Five and one-half-inch casing was then set inside the seven-inch and on top of the lead seal with a pin packer on the bottom of the 5½-inch. Three-inch tubing was then run back into the hole with a hook wall packer on bottom and a four-foot perforated nipple just above. Sodium dichromate solution was pumped down the annular space between the three-inch and 5½-inch and entered the produced fluid through the perforated nipple. The cost of this reconditioning program was $500,000 for the field. On the basis of the field producing 200 mm cubic feet of gas per day for the 21-month interval from April, 1944, to January, 1946, the prorated corrosion cost is $3.90 per mm cubic feet of gas.

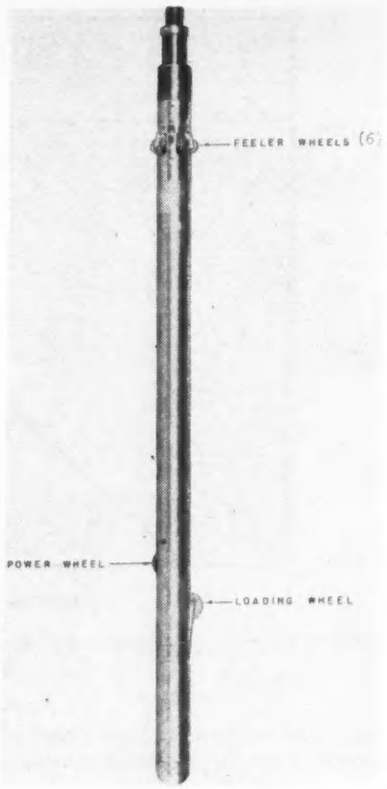


FIGURE 4. Tubing caliper.

A second company has furnished corrosion cost figures for fields in Jefferson and Chambers County, Texas. They report:

Corrosive wells	23
Non-corrosive wells	11
Total	34
Workover Costs	(5 Years)
1944 well A	$5,000
1945 well B	21,000
1946 well C	11,400
1947 well D	11,100
Total	$48,500
Preventative methods (five years)	60,000
Grand Total	$108,000
Gas Produced	36,166 MM cu. ft.
Corrosion cost per MM cu. ft.	$3.00

A third company reported the following for a field in Colorado County, Texas.

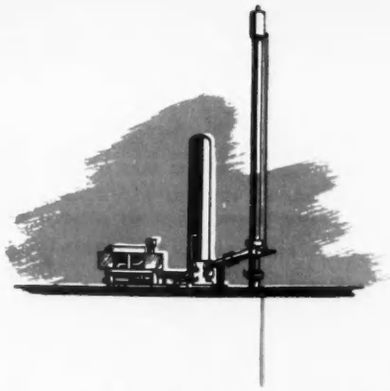
Corrosive wells	10
Non-corrosive wells	5
Total	15
Average producing depth 8500 feet.	
Average producing rate 5 MM cubic feet per day.	
Period involved, August 1, 1945, to July 1, 1947.	
Cycling started August 1, 1945.	
Workovers (7):	
Contract services	$112,730
Replacement materials	23,320
Miscellaneous materials and services	13,060
Total	$149,110
Corrosion Preventative Costs:	
Inspection of trees, etc	$ 28,280
Water analysis	13,000
Chemical inhibition	49,775
Total	91,055
Field Supervision	$10,000
Grand Total	$250,165
Corrosion cost per MM cu. ft. of gas	4.80

A fourth company has given approximate cost data for a large Texas Gulf Coast field. After two years operation it was necessary to pull about 25 strings of tubing for replacement. They estimate an annual cost for these repairs of $250,000. Prorating the repair cost over the gas handled per day results in a corrosion cost of $1.40 per mm cu. ft. of gas.

A fifth company reported the following corrosion costs from four wells in three fields:

8- 6-46 Field A(Workover and replaced tubing)	$13,178
12-30-46 Field B Workover and replaced tubing)	$75,214
2-12-47 Field B (Workover and replaced tubing)	$62,428
7-31-47 Field C (Replaced 2 master valves)	$ 360
Grand Total	$151,180
Total gas produced	25,300 MM cu. ft.
Cost per MM cu. ft.	$5.90

The average corrosion cost for all companies per mm cubic feet of gas becomes:



Deepest rod pumped oil well in the World!

11,341 Feet pump setting...

that's the record set by a major oil producer at Greely Field, California... 1¼" bore pump... 1", ⅞" and ¾" tapered sucker rod string... 4 20-foot strokes per minute... 135 B/D... fluid at pump level... began pumping on March 15, 1947... PELTON'S *Long Stroke* HYDRAULIC JACK on the job from the very beginning ...and to date THERE HAVE BEEN NO ROD PARTINGS AND NO PUMP JOBS!

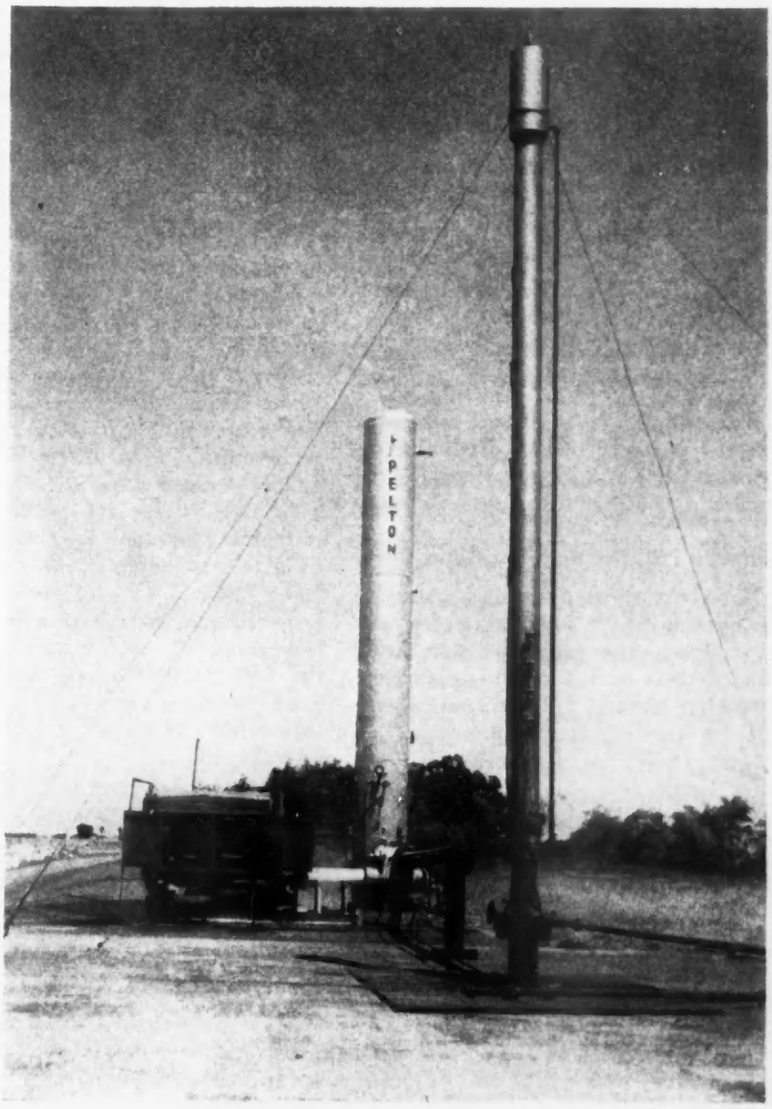
That's a logged record!

PELTON'S 20 foot constant velocity stroke, together with fewer and softer controlled rod reversals, guarantee longer life for sucker rods and bottom hole equipment.

Recent field records from another major oil producer show an AVERAGE DECREASE IN ROD PARTINGS OF 95% when the PELTON *Long-Stroke* HYDRAULIC JACK replaced the conventional pumping unit.

Whether your pumping depth is 2,000 feet or 12,000 feet, PELTON Engineers have facts and figures to prove how a PELTON JACK increases production—decreases costs. Write now for Bulletin No. 38.

PELTON JACKS are backed by more than 65 years of specialized experience in the design and construction of hydraulic equipment.



11,341 FT.

LONG-STROKE HYDRAULIC PUMPING JACK

PELTON

THE PELTON WATER WHEEL COMPANY
2929 NINETEENTH STREET • SAN FRANCISCO 10, CALIFORNIA
SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS

BLW THE BALDWIN GROUP

District Offices In HOUSTON · ST. LOUIS · SAN FRANCISCO · BIRMINGHAM · Other Principal Cities

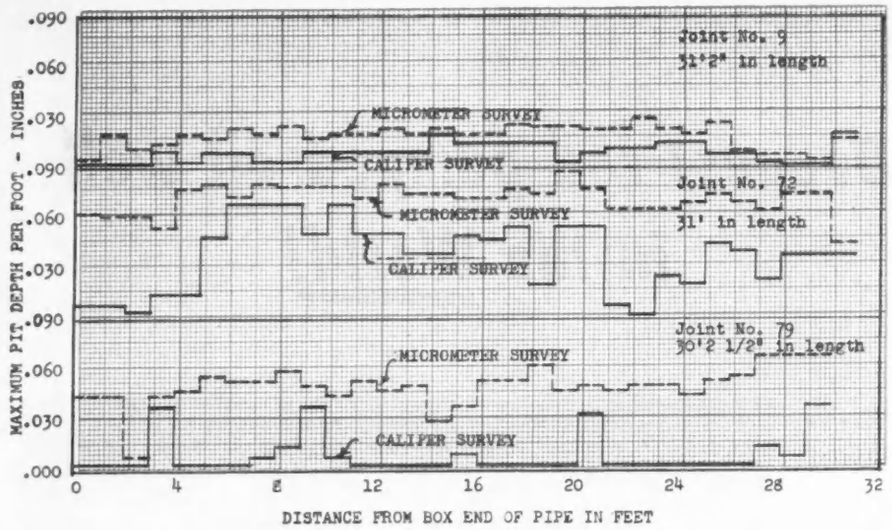


FIGURE 5. Comparison of tubing caliper survey and actual pit depth by micrometer measurement for three joints of tubing (2½-inch external upset tubing).

Company 1	$3.90
Company 2	3.00
Company 3	4.80
Company 4	1.40
Company 5	5.90
Grand Average	$3.80

At a selling price of $50 per mm cubic feet of gas the corrosion costs based on gas alone, not including condensate production, is 7.6 percent of gross revenue.

Methods for Reducing Corrosion Costs

Numerous efforts have been made by the oil industry to find ways and means of reducing these high corrosion costs. Out of these varied schemes there are appearing rational and successful methods for combatting the problem. The measures taken may be considered along three lines.

1. Protective coatings
2. Corrosion resistant metals
3. Chemical treatment

To date the most successful protective coating is a baked-on phenolic resin. Application is to pickled, sand-blasted metal. Costs are high and approximately double the cost of the tubing. The ratio of cost of the coated tubing to uncoated tubing is about 3:1. Numerous strings of such coated tubing have been in service in producing wells up to 30 months. Caliper surveys show some of these to have areas where the coating is gone and pitting has appeared, some are in good condition, while still others have failed through loss of coating at the threaded ends of the pipe followed by leakage of gas through the threads into the well annular space. Coatings can never be depended upon for unlimited successful service and this material is no exception.

The National Association of Corrosion Engineers has completed a test on 32 metals exposed to seven corrosive condensate well fluids. The performance of these alloys in terms of superiority relative to J-55, the common grade of steel tubing, is given for one of the tests. In this comparison the ratio of service is based on J-55 as 1.0. The data in decreasing order of resistance are:

Order	ALLOY	Relative Service to J-55 Steel
1	Aluminum Alloy, 35½H	9000
2	Aluminum 61-ST	4500
3	11-13 Chrome Steel	1640
4	Type 347, 18-8 Stainless	1200
5	Croloy 12	1200
6	K Monel Metal, Aged	490
7	Type 316, 18-8 Mo. Stainless	340
8	Type 304, 18-8 Stainless	222
9	Croloy 9	143
10	Ampco Grade 8	140
11	Nickel	58
12	Admiralty, Antimonial	43
13	Nickel Plated Steel	41.4
14	9 Percent Nickel Steel	36
15	70-30 Copper-Nickel	35
16	Red Brass	19.0
17	Everdur	14.5
18	3 Percent Nickel Steel	8.8
19	Copper Metal	6.7
20	Copper Plated Steel	5.6
21	5 Percent Nickel Steel	3.6
22	Galvanized Steel	2.56
23	Grade 8 Stainless	2.2
24	Croloy 5	2.1
25	Yoloy Steel	1.54
26	Cor-Ten Steel	1.47
27	Copper Bearing Steel	1.45
28	Croloy 2¼	1.27
29	.40 C. Cast Steel	1.27
30	J-55 Steel	1.00
31	H-40 Steel	.83
32	N-80 Steel	.80

This table of relative service of various alloys is of considerable importance. It shows H-40 and N-80 steels to be slightly less resistant than J-55. It shows the common low-priced alloys, yoloy, cor-ten, and copper bearing steel to have a rating of 1.45 to 1.54. This is insufficient difference to warrant considering for condensate well service. What is really desired is a low cost alloy with a service ratio of at least ten. It will be noticed that the various brasses, nickel, nickel-copper alloys, chromium steels of 9 percent or greater, 18-8 stainless steel and aluminum all show such service ratings. Of these, aluminum, nickel-copper, and brass alloys are out because of both strength and cost. This leaves for tubing, valve and Christmas tree parts nickel plated steel, 9 percent nickel steel, 9 percent chrome, 12 percent chrome and 18-8 chrome nickel alloys as offering excellent service possibilities. As a result of these tests it appears that 9 percent nickel, 9 percent chromium, and possibly nickel plated tubing as well as the 5 percent nickel alloys are materials which offer from excellent to satisfactory corrosion resistance. These materials are most suitable for tubing construction and are not primarily adapted for Christmas tree or casing head parts. A large amount of pipe of these alloys and particularly of the 9 percent and 5 percent nickel grades are now on order or under test. It is believed that as much as 500,000 feet of these two grades of material

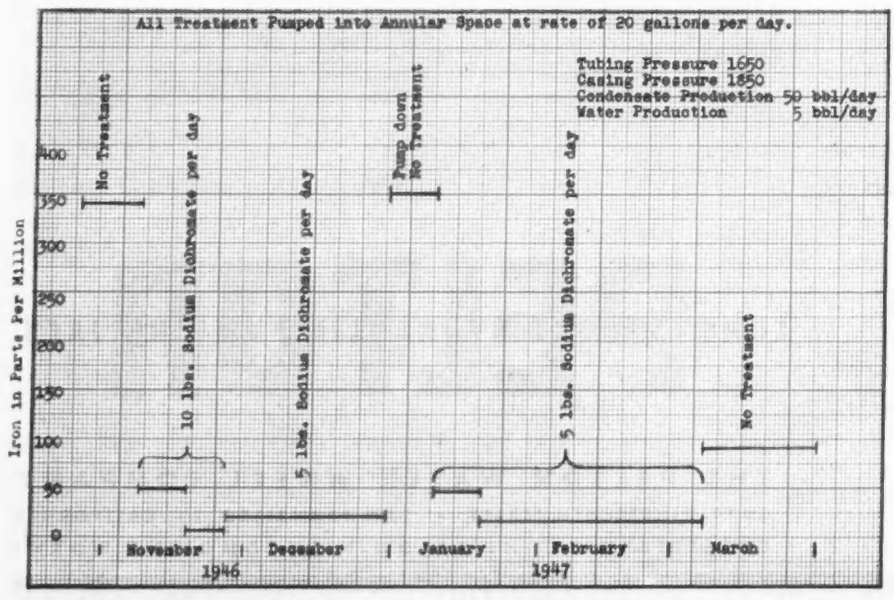


FIGURE 6. Down-the-hole treatment with sodium dichromate.

have been purchased. It is yet too soon to know whether the 9 percent nickel will give in service the same excellent corrosion resistance found on specimen testing but another year should answer this question. One fact has been established and that is the necessity for careful makeup of threads as this alloy has more of a tendency to gall than do the API grades of tubing steel.

Due to the high price of the 9 percent nickel alloy a large quantity of 5 percent nickel tubing has been purchased. This material did not have quite as good corrosion resistance as did the 9 percent nickel but in view of its much lower cost the material is being given extensive field testing to prove its value.

Another possible useful grade of tubing is the 9 percent chromium alloy. This alloy in tubing form has a slightly higher cost than 9 percent nickel. The material does, however, have the properties of being heat treatable to give much higher physical properties than N-80 pipe. The 9 percent nickel tubing gives equal or slightly greater than N-80 properties. When it is desired to obtain appreciably stronger physicals than given by the 9 percent chromium alloy can be used.

Two excellent materials of construction for use as tubing hangers, Christmas tree parts, master valves, flow beans, etc. were also found from the NACE tests. These are 18-8 stainless steel and 11-13 chromium steel. The 18-8 alloy has a high degree of corrosion resistance but does not possess sufficient strength to be used as the material of construction. It is used principally, therefore, as a lining material. The method of application is to machine the surface to be protected down by one-eight- to one-fourth-inch and to either weld sheet 18-8 in place or lay 18-8 weld metal in place and machine the surface to size. Where plug valves are so protected the plug is usually coated with a different material such as stellite to prevent galling. Such a method of protecting well head equipment is more expensive than using a single casting alloy for the material of construction. As a result there is a growing adoption of the 11-13 percent chromium casting alloy for portions of the Christmas tree such as the master valve, tees, crosses, wing valves, chokes, etc. The alloy is sufficiently strong to be used without the necessity of backing with steel. This alloy has been service tested in the field for a couple of years and has given excellent service.

Where chemical treatment can be used, successful treatments have been developed. It is preferable to treat only such wells as have the tubing open ended or have a perforated nipple above the packer. In these cases the chemical treatment can be pumped or lubricated down the annular space between the tubing and casing and returned up the tubing along with the corrosive fluids. Where the tubing is set on a packer and the annular space filled with mud it is not easy to treat the tubing chemically but it can be done if necessary, and in some cases good results have been obtained. In this case the well is closed in and from ten to 20 gallons of an aqueous solution of the treatment slugged to bottom. The solution coats the walls of the tubing on the way down and after it hits bottom the well is put back on production. Treatments 24 hours apart are working satisfactorily in some cases.

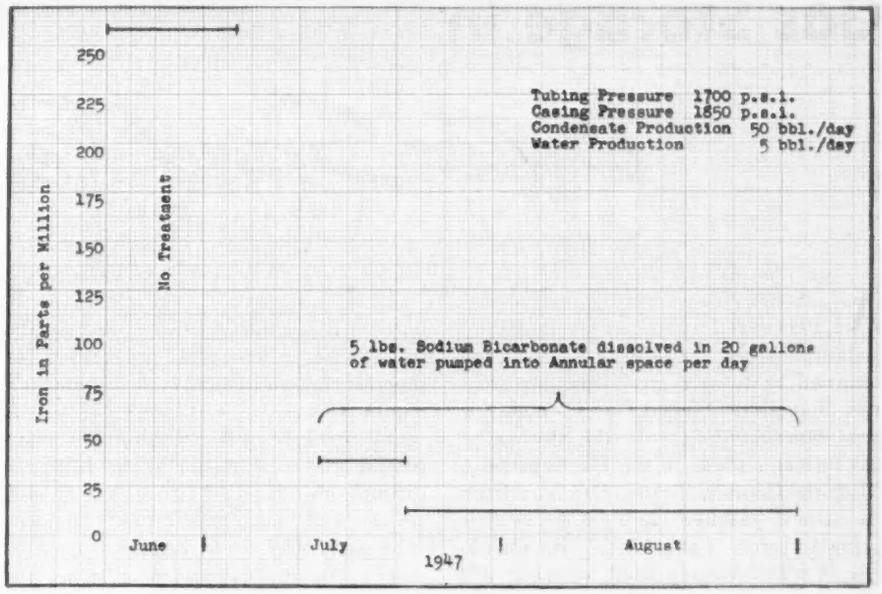


FIGURE 7. Down-the-hole treatment with sodium bicarbonate.

It has been found that any of the common alkaline materials can be used for this purpose. This includes soda ash, sodium hydroxide, ammonium hydroxide, and sodium bicarbonate. If the fluid pH can be raised to 7.5 by such treatment the iron content of the produced water usually falls to a negligible amount. Where the water contains large amounts of calcium, care must be taken in the treatment that calcium scale not be deposited. Some companies prefer to use sodium bicarbonate for this purpose in the belief that the precipitation of calcium carbonate will be kept to a minimum.

If it is not desired to use alkaline agents, either sodium bichromate or sodium chromate is used. These have been very successful in places but have the disadvantage of being reduced in some wells to insoluble chromic compounds which plug the tubing. Several pounds of the chemical are required per well per day. The amount is regulated by the amount of iron which it is felt is safe to allow in the effluent water.

The results of the use of sodium dichromate and sodium bicarbonate on a Gulf Coast well are shown in **Figures** 6 and 7. It will be noted that the use of these chemicals reduced the iron content of the produced water from 275 to 350 ppm down to 15 to 20 ppm, a reduction of about 95 percent.

Summary and Conclusions

Corrosion costs from producing condensate gas have been found to approximate $3.80 per MM cubic feet of gas. To combat this high rate of corrosion several principles should be followed with regard to completing and operating such wells.

First. No corrosive condensate well should be completed as a dual producer as such a completion hinders the use of chemical treatment and leaves the operator faced with high corrosion costs.

Second. All condensate wells should be equipped with a corrosion resistant master valve regardless of the type tubing in service or whether chemical treatment is under use or not.

Third. Condensate wells should be equipped with one of the grades of corrosion resistant tubing now available to prevent any necessity of chemical treatment.

Fourth. Where chemical treatment down-the-hole is to be used the tubing should be set on a packer with perforated nipple above as this has been found by several companies to give superior results over treating wells with open-ended tubing.

Fifth. Where chemical treatment is to be used, sodium bicarbonate or sodium bichromate in aqueous solution are usually found successful although sodium bicarbonate is preferred by the writer.

ACKNOWLEDGMENT

The author wishes to thank the executive department of the Gulf Oil Corporation for permission to publish this work.

Gas Storage in *Water Sand Reservoir* at Hastings

ALTHOUGH there are a number of instances where natural gas has been returned to former gas sands for storage, Stanolind Oil and Gas Company is now experimenting with the storage of gas in water sands in the Hastings field, Brazoria County, Texas. Dry gas from its natural gasoline plant in the field is being injected in the lower Frio formation, a water-bearing sand, where it will be stored for later sale. Since the Hastings oil reservoirs are water-driven, the solution gas produced is not needed for repressuring and is available for marketing or storage.

On April 17, 1947, injection of plant residue gas was started in the reservoir through the B. L. Turner No. 1 well which had been perforated between 6674 and 6694 feet. Except for shutdowns during three workovers on the well, approximately 21,000 Mcf of gas per day has been injected into the sand at a pressure of 3000 pounds per square inch. By March 1, 1948, about 5,800,000 Mcf had been injected into the formation. Arrangements are now being made to deepen a second well into the storage reservoir to serve as a stand-by injection well and to permit experimental production of some of the gas to determine the expected recovery rates.

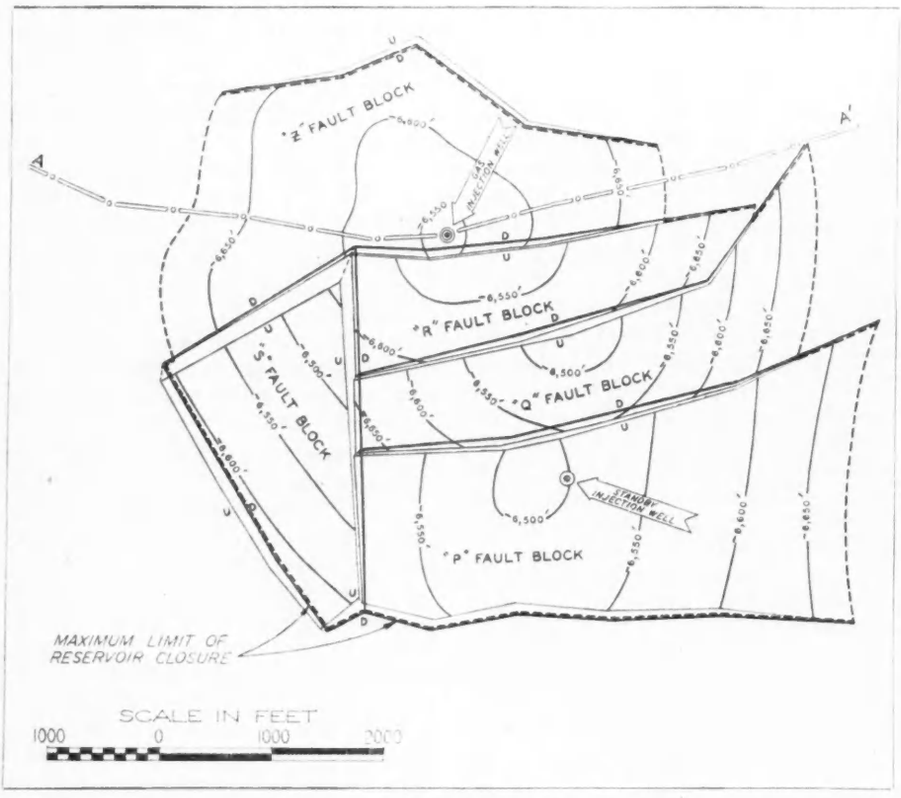


FIGURE 1. Map 2, gas storage reservoir, Hastings field, showing future areas to be occupied by injected gas.

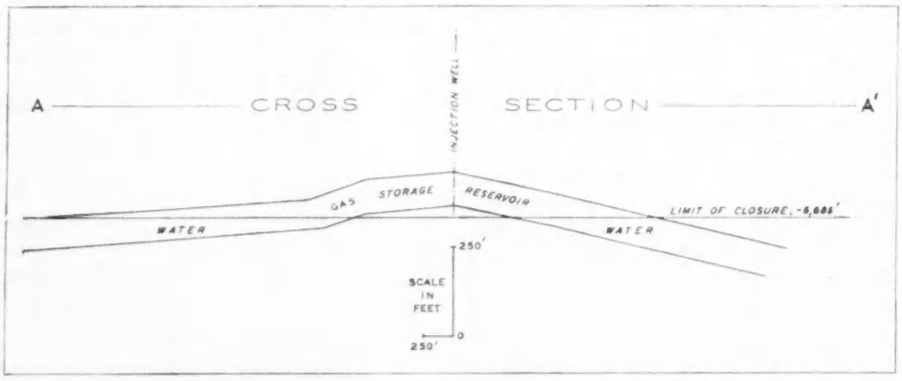


FIGURE 2. Cross-section A-A' gas storage reservoir, Hastings field.

Source of Gas

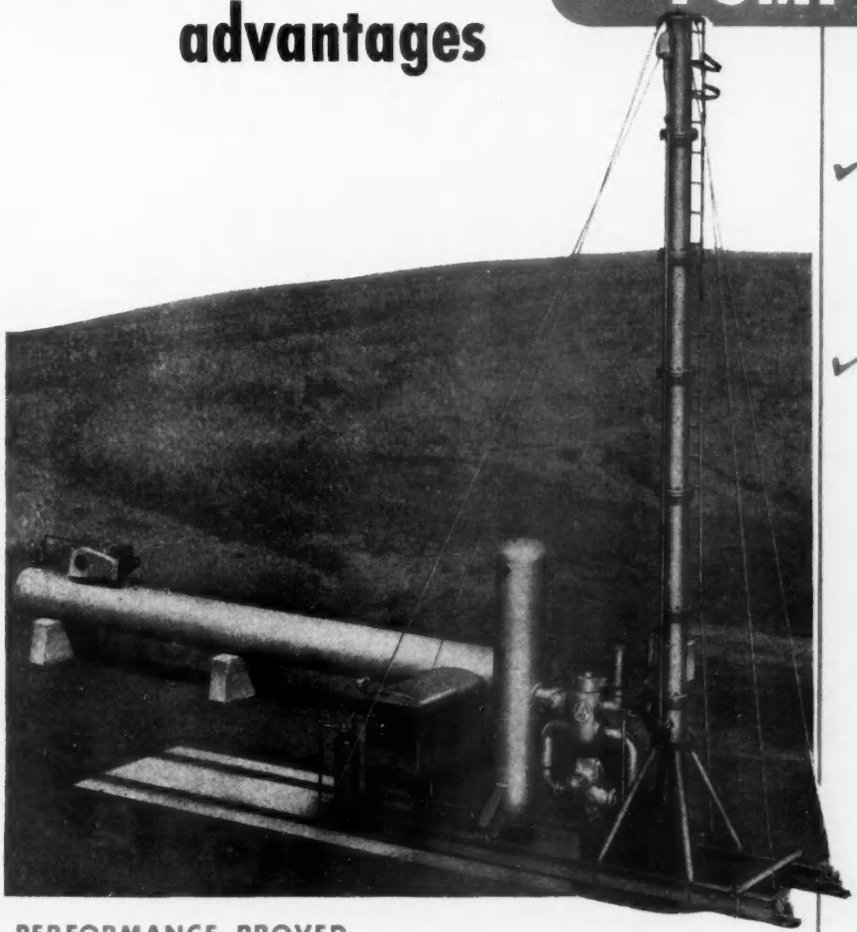
Source of the gas is the Stanolind natural gasoline plant completed in 1947 to process between 30,000 and 40,000 Mcf of gas a day. In present operations about 23,500 gallons of 12-pound revapor pressure natural gasoline, 14,200 gallons of butane, and 9300 gallons of propane are being extracted daily in the natural gasoline plant. In addition to the 21,000 Mcf going into storage daily, 9000 Mcf per day is being used at 700 pounds per square inch to gas-lift oil to the surface in wells which have ceased natural flow. This gas-lift operation has circumvented the installation of expensive pumping equipment.

The gas is being injected into a sand 600 feet below the Hastings oil reservoir. This sand is water-saturated and the injected gas produces a gas bubble in the top of the sand. As more gas is injected, the bubble expands and displaces the water. The capacity of the reservoir is limited by the closure of the fault blocks. If sufficient gas were injected to depress the gas-water interface below the limit of closure, gas would seep out of the reservoir and be lost.

The map (Figure 1) shows the five fault blocks which comprise the storage reservoir and the location of the injection wells. Intercommunication is indicated between these fault blocks where the throw of the fault is less than the thickness of the sand. On this basis, it is believed there is intercommunication between all fault blocks adjacent to each other except between the "S" block and its adjoining "R" and "Q" fault blocks. Structural interpretation of the lower sand has been difficult because only one well has been drilled to it. The locations of the fault blocks in the gas injection sand have been projected from the upper Frio sand 600 feet higher. This pro-

Check these profit-producing advantages

The New AXELSON HYDRAULIC *Long Stroke* PUMPING UNIT



PERFORMANCE PROVED—
First built and tested in 1938, seven units have been in successful operation continuously since 1940 on 7,000 to 8,000 foot wells with 1 ¼" and 1 ½" bore pumps.

ADVANTAGES:

- **INCREASED STROKE LENGTH**—up to 26½ feet total—reduces stroke loss due to rod and tubing stretch, increases plunger travel, decreases frictional wear, and assists in handling gassy fluids.
- **FEWER STROKE CYCLES PER MINUTE**—from 3 to 6 spm—reduces string reversals, decreases impulse load factors and problems created by second and third order synchronous speeds, permits operator to increase pump size or depth or lighten the rod string.

RESULTS:

- **LONGER SUCKER ROD LIFE**—because operational characteristics of the long stroke unit reduce peak stresses, stress range and cycle rate, and provide cushioned power application.
- **TROUBLE-FREE OPERATION**—effects savings by eliminating down-time. These units are easy to maintain, operate on low pressures, and contain automatic safety features.
- **GREATER PRODUCTION AT LESS LIFTING COST**—over relatively fast, short stroke pumping, through greater volumetric efficiency, reduction in stroke loss, the ability to increase pump size, and a tremendous reduction in string-failure down-time.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON

HYDRAULIC *Long Stroke* PUMPING UNIT

Producers of Deep Well Plunger Pumps, Sucker Rods and Accessories since 1892.

AXELSON MANUFACTURING CO. • Plants—Los Angeles 11, St. Louis 16
Offices—New York City 7, Tulsa 1

FOR MORE INFORMATION—write today for fully illustrated, completely descriptive Axelson Bulletin #4800.

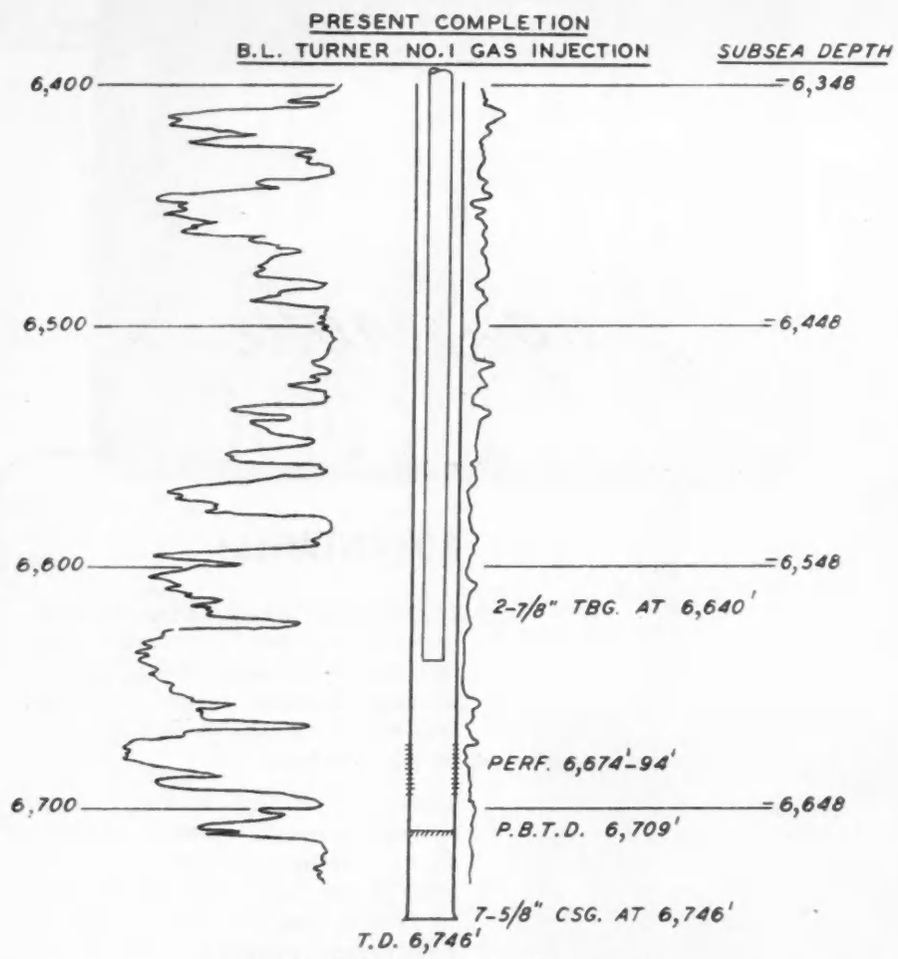


FIGURE 3. Completion plan of B. L. Turner well.

TABLE 1
Daily Average Injection Pressures and Rates
B. L. Turner No. 1 G.I.

Date	Injection Pressure Psi.	Injection Rate MCF/Day	Remarks
April 25, 1947	3600	13,851	
April 26—May 2	3307	10,701	Well acidized May 2. Backflowed 3½ hours May 2.
May 3—May 9	2725	12,206	
May 10—May 16	2750	12,347	
May 17—May 23	2730	10,410	
May 24—May 30	2800	12,453	
May 31—June 6	2818	12,045	
June 7—June 13	2843	12,788	
June 14—June 20	2829	12,259	
June 21—June 27	2864	13,821	
June 28—July 4	2983	14,072	
July 5—July 11	3121	13,745	
July 12—July 18	3166	13,639	
July 19—July 25	3223	14,621	
July 26—August 1	3294	14,607	Backflowed 2½ hours on July 28
August 2—August 8	3057	14,270	Well acidized August 2. Backflowed 1½ hours August 2.
August 9—August 15	3012	15,730	
August 16—August 22	2962	15,099	
August 23—August 29	2926	14,133	
August 30—September 5	3003	19,772	
September 6—September 12	3087	19,252	
September 13—September 19	3132	19,274	
September 20—September 26	3160	18,286	
September 27—October 3	3371	21,619	
October 4—October 10	3448	22,001	
October 11—October 17	3555	22,215	
October 18—October 24	3547	22,568	
October 25—October 31	3492	21,669	Well acidized October 30—Gas Scrubber installed October 30. Maximum injection rate to date occurred on November 2 when 24,883 MCF of gas was injected at 3040 psi pressure.
November 1—November 7	3064	23,911	
November 8—November 14	3090	23,137	
November 15—November 21	3082	21,863	
November 22—November 28	3048	20,962	
November 29—December 5	3029	20,734	
December 6—December 12	3014	19,874	
December 13—December 19	3041	21,641	
December 20—December 26	3042	20,816	
December 27—January 2	3044	20,193	
January 3—January 9	2908	18,750	
January 10—January 16	2946	20,617	
January 17—January 23	2935	20,472	
January 24—January 30	2852	19,518	
January 31—February 6	2918	20,277	

jected cross section is shown in Figure 2.

Based on a minimum limit of closure at 6685 feet below sea-level, the net volume for storage in the reservoir is about 7000 acre-feet. This will provide storage space for about 70 billion cubic feet of gas—equivalent to the plant output of residue gas for a period of more than eight years.

The B. L. Turner No. 1 injection well was spudded on December 11, 1946, and completed January 14, 1947, after coring through the sand encountered at 6592 feet (6540 feet below sea level). Seven and five-eights-inch casing was set at 6746 feet with 1950 sacks of cement and the plug was drilled to 6709 feet. Casing was perforated with five shots per foot between 6674 and 6694 feet and 2⅞-inch tubing hung at 6639 feet. The well was washed with salt water before the injection of the gas. A sketch of the well showing completion and reservoir data is shown in Figure 3.

Injection tests were begun on January 16, 1947, using gas from the Margaret Kidd No. 2 gas well. A portable compressor at the Turner well was used to obtain pressures equivalent to those expected from the plant. Over a period of three months, 230,682 Mcf were injected into the Turner well, establishing that gas could be injected into the reservoir at approximately 3000 psi pressure. The injection of plant residue gas began April 17, 1947, with 13,851 Mcf per day being injected at 3600 psi.

Acidizing the Well

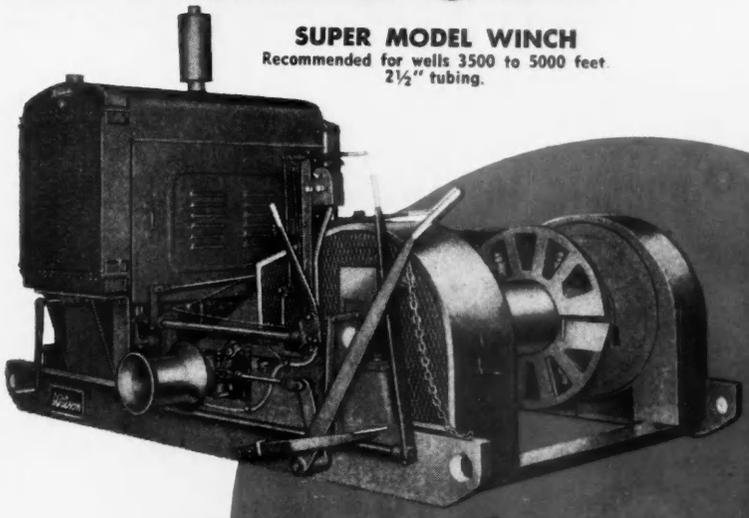
The high initial pressure caused concern and it was decided to acidize the well to clean the sand face opposite the perforations. During the backflow, a dark brown, viscous, greasy substance appeared. This substance is believed to have been lubricating oil passed from the compressors into the well.

After the first acidization, gas could be injected at 2720 psi, but injection pressure steadily increased until it reached 3500 psi on July 25. A second backflow and acidization also showed the greasy lubricant. A third acidization became necessary October 30 when pressures exceeded 3500 psi. At that time a scrubber was installed to remove contaminants in the gas. There has been no further excessive pressure build-up since the scrubber was installed. Table 1 shows the daily average injection pressures and rates, and a record of the workovers on the well.

A standby well, the Margaret Kidd No. 2, is now being deepened to the storage horizon. It will penetrate the same lower Frio sand high in the "P" fault block, and will eventually serve as a well for the production of stored gas.

Wilson WINCHES

SUPER MODEL WINCH
Recommended for wells 3500 to 5000 feet 2½" tubing.



1 CAST, SEMI-STEEL BRAKE RINGS Machined after assembly for true running braking surface

2 WILSON DISC TYPE FRICTION DRUM CLUTCH, or FREE ROLLING JAW CLUTCH DRUMS, optional

3 FULL HARDENED, DOUBLE STEP, REPLACEABLE JAW CLUTCHES

4 CAM OPERATED, FULLY EQUALIZED SELF-ENERGIZING FULL WRAP BRAKES

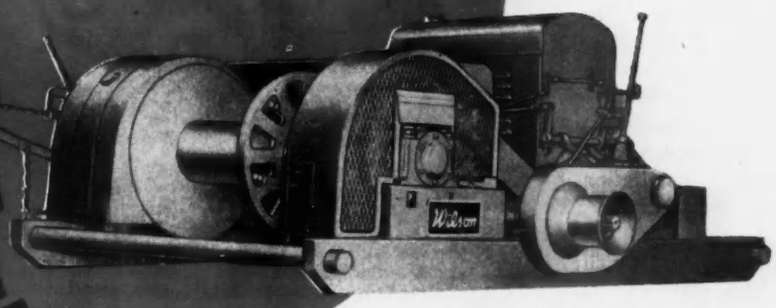
5 ALLOY STEEL, DOUBLE HEAT TREATED SHAFTS, accurately ground to size

6 SPLINED SHAFTS wherever possible

7 HEAVY DRUM BARRELS, reinforced inside

8 DRUM ENDS REINFORCED WITH HEAVY "T" SECTION RIBS

9 DRUM BEARING BOLTS CLEAR THROUGH FRAME



SENIOR MODEL WINCH
Recommended for wells up to 3500 feet 2½" tubing

Longer life, faster operation, more time on the job is what you get when your winch is a Wilson. Powerful, self-energizing brakes give instant response when needed. Jaw or friction clutches are optional, each the best of its type (Super and Mogul Models can be equipped with the Wilson Air-Tube Disc Clutch). Four or eight forward speeds and one or two reverse speeds make these winches flexible enough for all requirements.

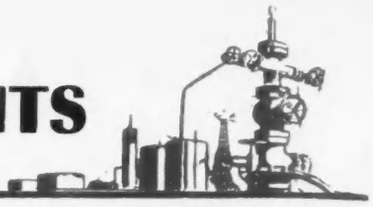
Famous for Performance the World Over

ABOVE MODELS READY FOR DELIVERY FROM THESE POINTS

JACK ANDERSON ENGINE COMPANY, Kilgore, Texas
NORVELL-WILDER SUPPLY COMPANY, Houston, Texas
MID-CONTINENT SUPPLY COMPANY
Shreveport, La.; Wichita Falls, Texas; Odessa, Texas; Kilgore, Texas
AMERICAN SUPPLY COMPANY, Kilgore, Texas
MIDWAY TOOL COMPANY, Mount Pleasant, Michigan
DIXIE IRON WORKS, Alice, Texas
JONES & LAUGHLIN SUPPLY COMPANY
Wichita Falls, Texas; Carmi, Ill.; Duncan, Okla.; Odessa, Texas; Casper, Wyo.
EMPIRE OIL FIELD MACHINERY COMPANY, Odessa, Texas
GEHRING EQUIPMENT COMPANY, Casper, Wyoming
SUPERIOR IRON WORKS & SUPPLY COMPANY, Shreveport, Louisiana
POWER RIG & EQUIPMENT COMPANY, Los Angeles, California

Wilson
MANUFACTURING CO., Inc.
WICHITA FALLS, TEXAS

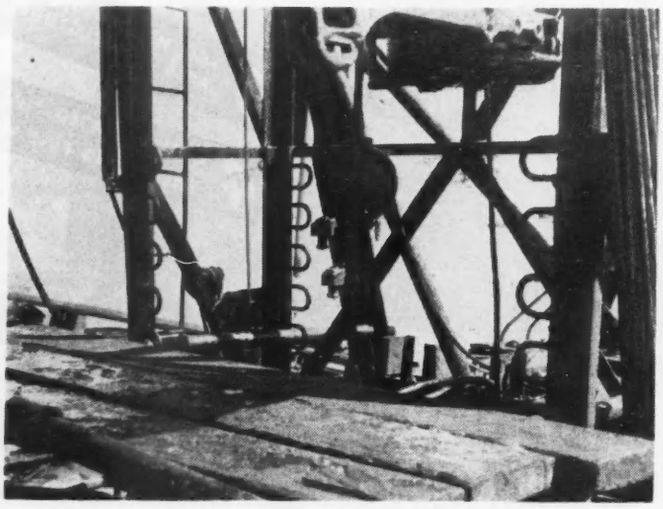
PRODUCTION HINTS



$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Build Adjustable Loop Supports for Working Platforms

The use of portable service units on wells not equipped with derricks has greatly simplified routine well-pulling and workover operations. In most instances, crews work at the ground level or perhaps slightly elevated platform surrounding the well head, but on some jobs, pressure control equipment must be used, necessitating installation of an elevated floor. To provide a means of supporting such working platforms at any desired height without having to custom-build a support for the particular conditions found on each well, one production service company welded a series of loops to the four legs of their portable derrick.

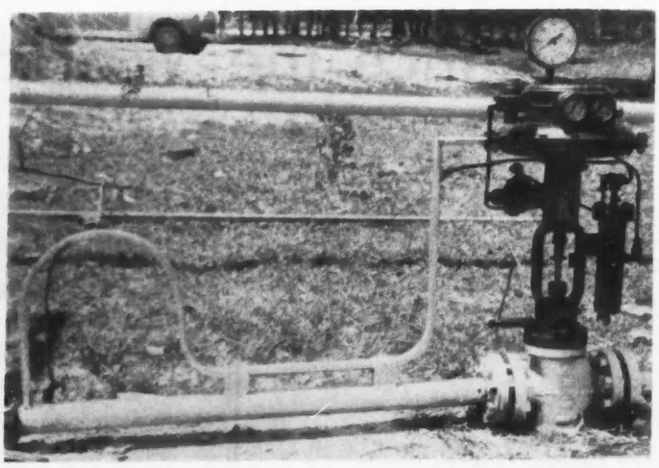


As shown in the photograph, the loops provide a means of supporting two lengths of three-inch pipe or tubing, atop which can be laid planks on which the men can walk. Under ordinary circumstances, for the comparatively light weight of the men working upon it, the platform requires no further support. If desired, however, a light horse or other support can be placed under the outer ends of the pipe to lend greater stability. The round bar loops on the derrick legs, however, take up most of the weight of the platform.

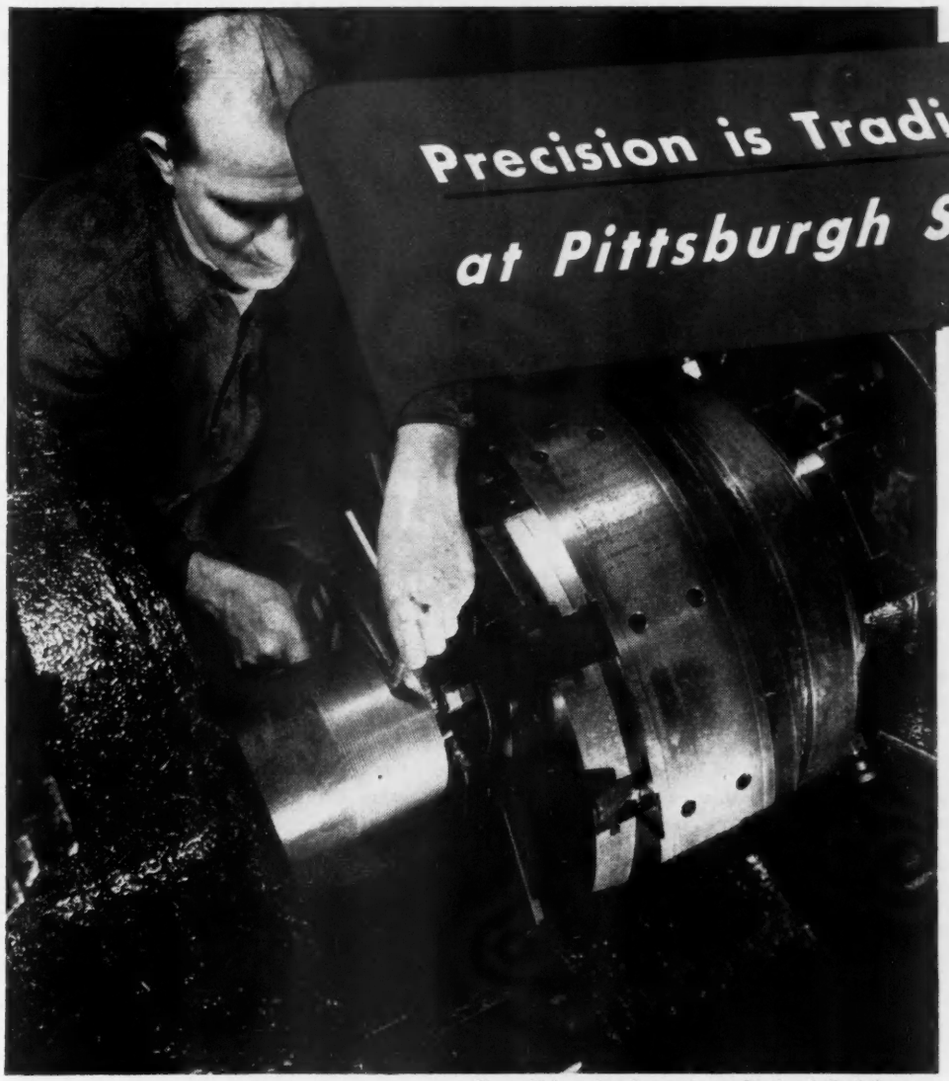
The loops do not interfere with other operations around the derrick structure. Besides permitting a more rapid setting-up of the equipment, the method of support provides a more accessible under-floor space in which men can work on casing head fittings without interference of legs or blocking.

HOW TO—Protect Copper Tubing on Vent Lines with Channel Iron

On vent lines and other places where regulators are installed, it is sometimes necessary to run copper tubing some distance from the regulator for remote control or to get the point from which the pressure is taken away from the valve where turbulence and freezing occur. One company forms a "canopy" over the copper tubing by using 1 x ⅜-inch channel iron and welding it to braces which cause it to effectively protect the copper tubing from damage. Copper tubing is as important as the valve itself and damage to the tubing may cause serious damage on a separator vent line, pipe line, or in a refinery.



As shown in the photo, the channel iron is tack welded to the pipe line near the pipe tap for the copper tubing. It is then arched over the tubing to take the same shape as the tubing. Where it is parallel to the pipe, heavy braces are welded between the channel iron and the pipe. The channel iron then bends back up perpendicular to the pipe and then back horizontally where it is tack welded to the side of the diaphragm case.



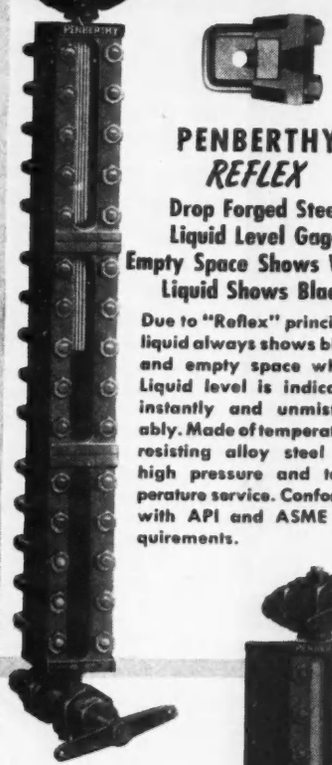
Henry Nalepa threading casing at Pittsburgh Steel Company

Pittsburgh Seamless oil country goods give you good reliable service year in and year out because of tradition—for example the tradition of making precision threads. As pioneers in precision threading Pittsburgh workmen aided by expert technical advice and up-to-date equipment have continued to lead in producing the best in seamless drill pipe, casing and tubing. This leadership is a moving force as we constantly seek ways to improve methods—so that we may better meet the requirements of the oil and gas industry. Pittsburgh Steel Company, 3268 Grant Building, Pittsburgh 30, Pa.

PITTSBURGH STEEL COMPANY

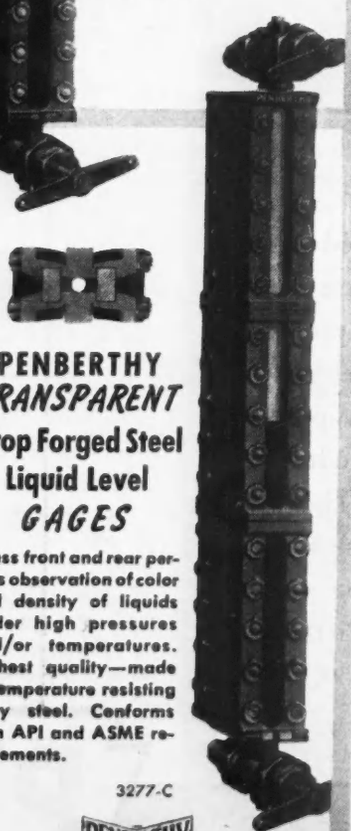
P

PENBERTHY
REFLEX and TRANSPARENT
DROP FORGED STEEL LIQUID LEVEL GAGES



PENBERTHY
REFLEX
Drop Forged Steel
Liquid Level Gage
Empty Space Shows White
Liquid Shows Black

Due to "Reflex" principle, liquid always shows black and empty space white. Liquid level is indicated instantly and unmistakably. Made of temperature resisting alloy steel for high pressure and temperature service. Conforms with API and ASME requirements.



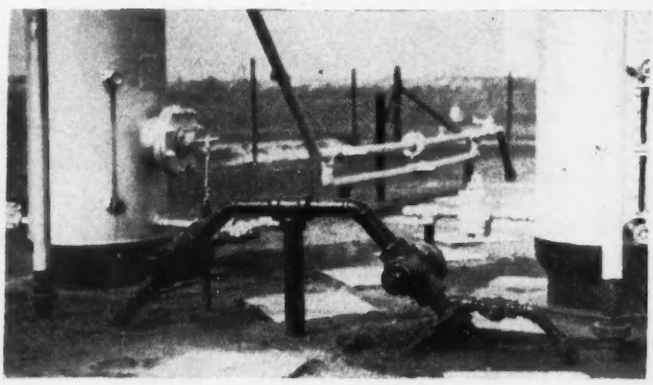
PENBERTHY
TRANSPARENT
Drop Forged Steel
Liquid Level
GAGES

Glass front and rear permits observation of color and density of liquids under high pressures and/or temperatures. Highest quality—made of temperature resisting alloy steel. Conforms with API and ASME requirements.

3277-C

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

HOW TO—Simplify Dual Gas Separator Hookup

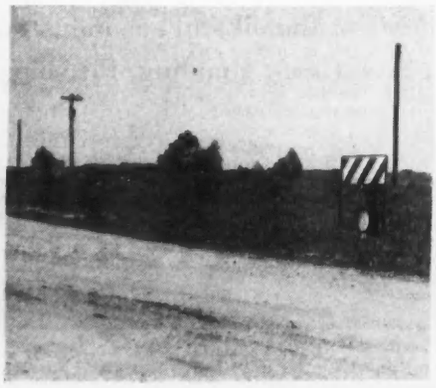


It is necessary, in high-pressure gas-distillate fields, to provide multi-stage separation of gas and liquid. Successive stages of separation bring the gas down to a pressure which is practical for the transportation of gas through field gas lines. A dual stage separation hookup is illustrated. High-pressure gas and distillate enter the high-pressure separator shown at right. Liquids are removed and gas is taken off at the top of the separator, the pressure is reduced, and the gas enters the low-pressure separator shown at left. Any liquids in the gaseous state at the higher pressures are removed by the low-pressure separator. Liquid from both separators is dumped into stock tanks for storage.

Connections to both separators have been simplified by an arrangement which permits operation of either separator for the high-pressure stage. The 2½-inch riser in the foreground is the flow line from the well. A reducing tee connects two-inch lines to the intake of each separator. Plug valves control the flow of fluid through both lines. In the event that the regulator normally used for the high-pressure stage should fail and need repairs, it is a simple matter to switch the flow into what normally is the low-pressure separator. During the time the high-pressure separator is down only one stage of separation is provided. However, having two separators capable of handling such pressures eliminates completely shutting down the well because of a separator breakdown.

HOW TO—Protect Field Gas Control Equipment

In an established field where development of new wells is still in progress, gas from producing wells is used as fuel for steam rigs in the area. Gas is taken from the main system, the pressure reduced to about 50 pounds per square inch and measured before piped to the rigs. In such areas under development, gas lines are laid alongside existing roads



WEST TEXAS Engineering SERVICE

FOR
OIL FIELD PROPERTY MANAGEMENT

- GAS-OIL RATIO SURVEYS
- SUB-SURFACE PRESSURE AND TEMPERATURE SURVEYS
- WELL TESTS
- ENGINEERING ANALYSES AND APPRAISALS
- SUPERVISION OF PRODUCTION, DRILLING & ROYALTY INTERESTS

PRICES FURNISHED ON REQUEST

P. O. Box 1299
Rhodes-Chapple Bldg.
Phone 225
MIDLAND, TEXAS

COMPRESSORS

for large tonnage PROPANE REFRIGERATION

For the MEK Solvent Dewaxing Process in manufacturing lube oils, Clark is building seven Propane Centrifugal Refrigeration units to operate at approximately –20° Fahrenheit. Other Clark Propane Multi-Stage Centrifugal Compressors will operate at a higher temperature to cool absorber oil.

Clark's Multi-Stage Centrifugal Compressors, designed for use with Propane and other hydro-carbons as refrigerants, are particularly suitable for high pressures and large volumes. They can compress capacities from 2,000 to 120,000 c.f.m. with discharge pressures up to 475 lbs.

With the Clark multi-stage design, two or more compressors can be connected in line with one driver for through drive, thus saving floor space, also installation and operating costs. They can be driven either with a directly connected turbine or a motor through a speed-increasing gear.

Clark's Multi-Stage Centrifugal Compressors can be arranged quickly and easily to meet any desired pressure or capacity within the ranges stated above. Standardized design permits use of interchangeable parts and easy adaptation to different types of service, as well as speed in filling orders. Write for full information.

CLARK BROS. CO., INC. • OLEAN, NEW YORK

BIRMINGHAM, ALA. • BOSTON • CHICAGO • DETROIT • HOUSTON • LOS ANGELES • NEW YORK • WASHINGTON
SALT LAKE CITY • TULSA • LONDON • BUCHAREST, RUMANIA • CARACAS, VENEZUELA • PARIS, FRANCE

CLARK

ONE OF THE DRESSER INDUSTRIES

SETS THE PACE IN COMPRESSOR PROGRESS

to facilitate their installation. It was necessary to install a pressure regulator and orifice meter in this line. The 24-hour recording meter is shown at right and the pressure regulator to the left.

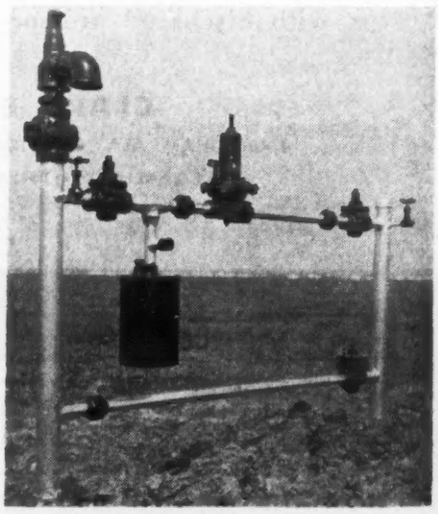
Since their location was at the juncture of two roads which form a "tee," the lateral road ending at the gas control equipment, it was necessary to place warning signs which were clearly visible at night. The dark color of the equipment was difficult to see from trucks and cars traveling lease roads at night. The warning signs are simply suspended boards painted with alternately red and white stripes. Each warning sign is suspended by a bracket of one-inch pipe shaped to hold the sign at desired height above ground level. These brackets are driven in the ground directly in front of the equipment. Drivers of oncoming vehicles at night can see these warning signs from a safe distance so they can slow down and prepare for the turn instead of crashing headlong over the equipment unaware of the turn and their location.

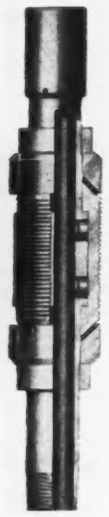
HOW TO—

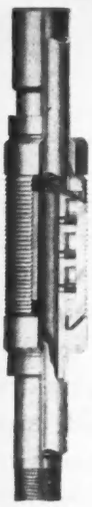
Group Gas Controls

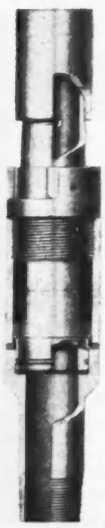
Where a connection is made on the main line for a lease or employees camp, all the connections including the gas odorizer may be mounted in the same run as shown. A collar is welded on the top of the main line and the tap made in the usual manner. The assembly shown may be made up in the shop or in the field, but usually a stock of these units is maintained in the shop. A stop valve and relief valve are mounted atop the riser from the lease line. Welded connections are made on the sides of the riser for a bypass line, delivery line, and a quarter-inch connection for a test line.

The riser from the main line also has a test connection with plug valves on the running lines. The regulator is mounted on the upper line and the pot which contains the odorizer is mounted on the down-stream side of the regulator. The odorant is dissolved in a light liquid so that it vaporizes as the gas passes over it and provides sufficient odor to make the gas safe for domestic consumption. A wick sticks up into the main line from the pot so that as more gas passes over it, more of the odorant is picked up by the gas stream. This system has worked so well that one company has standardized this practice and each of the regulator-odorizer runs are interchangeable.




Type "B" Tubing Anchor


Type "C" Tubing Anchor


Tubing Drain

On & Off Attachment

PAGE TENSION TOOLS

Announcing...

PAGE

TENSION TYPE

PRODUCTION TOOLS

at your

D + B and CONTINENTAL SUPPLY STORES

PAGE "TENSION TYPE" Production Tools—Tubing Anchors, Tubing Drains, and Sucker Rod On & Off Attachments—are available in the Mid-Continent through your nearest D+B and Continental Supply Stores. Check these new Tools. Get the *full* story on how *Page* Tools can cut production costs by keeping tubing in the hole longer!

PAGE TOOLS ARE *different*

TYPE "B" ANCHOR for ROD PUMP STRINGS: Page Type "B" Tubing Anchors set hydrostatically as the well pumps up!

TYPE "C" ANCHOR for MAIN AND PARALLEL STRINGS: Page Type "C" Tubing Anchors embody the same operation advantages as the Type "B" *plus* a special design for anchoring *both* main and parallel strings!

DRAIN AND BUMPER SUB COMBINED: Page Combination Tubing Drain and Bumper Sub affords a means of draining the tubing above the pump and can also be used as an effective up-jar!

ON & OFF ATTACHMENT for SUCKER RODS: Page's unique On & Off Attachment joins sucker rods to pump *after* tubing run-in—releases quick whenever desired!

FIELD RECORDS PROVE . . .

. . . that anchoring the Page Way *increases* pump efficiency and *decreases* equipment wear —visit your nearest D+B Pump Store or Continental Supply Store — find out how Page "Tension Type" Tools can help *you!*

PAGE OIL TOOLS, Inc.

3356 Lime Ave., Long Beach 7, Calif.

Mid-Continent Distributors

D+B Division—Emsco Derrick & Equipment Co., Garland, Texas

The Continental Supply Company Dallas, Texas

Satisfied Customers have no Substitute

Jensen begins 29th year of making quality pumping units

Americans are friendly folks. They like to give a newcomer a hand by buying new and untried products occasionally.

But unless they're satisfied with the article, Americans seldom—if ever—buy it again. Therefore any outfit that expects to stay in business had better satisfy its customers well enough to earn repeat sales.

This little angle of the American buying habit we learned 29 years ago. That's how long we've been making quality pumping units. And that's how long some of our old customers have stayed with us.

Once you see the design and construction details of a Jensen you will quickly realize why Jensen users are satisfied customers—why many of them have been buying Jensens for 29 years.

Visit your near-by Jensen dealer or write to Coffeyville for literature. See for yourself why Jensen units are so satisfactory on any well anywhere.

JENSEN

Bros. Mfg. Co., Coffeyville, Kan.

Export Office: 50 CHURCH STREET, NEW YORK CITY

I'M YOUR MAN

FOR IMPROVING PIPING SYSTEMS AND LOWERING PUMPING COSTS!...

VICTAULIC COUPLINGS build *flexibility* into any piping system. Your pipe line will follow building and land contours—without expense of engineered alignment. *A union at every joint* saves money, man-hours, material—installing, repairing, or salvaging. Every Victaulic Coupling is slip-proof and leak-tight—can't blow off or pull out under pressure, vibration, or sag.

VICTAULIC Elbows, Tees and other FITTINGS are *Full-Flow* . . . designed with long and easy sweeps that reduce internal friction to a minimum. They'll give your piping system increased delivery *—at lower pumping costs.*

THE NEW "VIC-GROOVER" grooves pipe ends twice as fast as ordinary pipe threaders . . . with half the effort. It's light-weight and ratchet operated . . . grooves exactly right *automatically.*

FOR FULL ECONOMY make your piping system ALL VICTAULIC!

WRITE TODAY for Victaulic Catalog and Engineering Manual No. 44-8 . . . and for new "Vic-Groover" Catalog No. VG-47.

SELF-ALIGNING PIPE COUPLINGS

VICTAULIC

EFFICIENT FULL-FLOW FITTINGS SIZES—3/4" THROUGH 60"

VICTAULIC COMPANY OF AMERICA

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Victaulic, Inc., 727 W. 7th St., Los Angeles 14, Calif.

Victaulic Company of Canada, Ltd., 200 Bay St., Toronto 1

For export outside U. S. and Canada: PIPECO Couplings and Fittings: Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

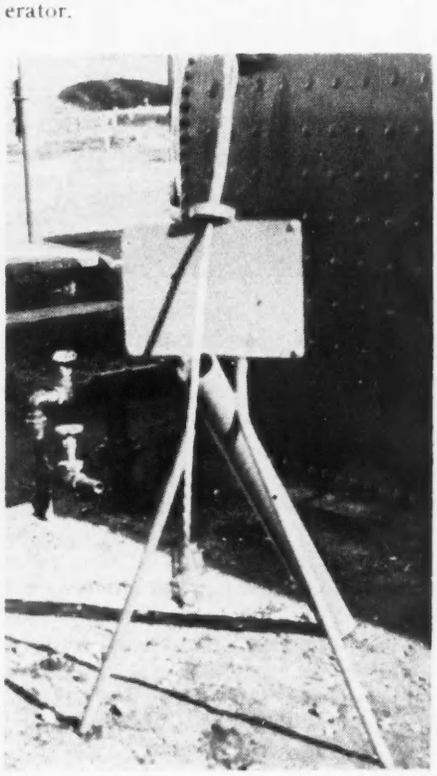
Copyright 1948, by Victaulic Co. of America

PRODUCTION HINTS

HOW TO—

Make Boiler Lighter

To provide means of lighting a fire in a cold boiler with assured safety to the operator, one producing company supplies the boilers at treating plants with a torch which is kept stored in a scabbard except during immediate use. The scabbard is a three-foot nipple mounted upon two legs so that the assembly takes the form of a tripod where the open end of the two-inch pipe nipple points conveniently towards the operator.



The torch is made from a convenient length of derrick guy line looped back sharply and bound with soft rope for a handle. The other end is unstranded with a handful of waste worked into the strands which are turned back and bound tightly as a swab. The two-inch pipe is partly filled with distillate or live oil so the swab is completely saturated so long as it is in the scabbard. Removed, the swab is lighted and introduced into the firebox through the door or through the opening in the mud ring below the door and the gas turned on. To keep the oil or distillate from evaporating, a circular washer-type cover is placed on the handle of the swab which fits snugly against the open end of the scabbard when the swab is stored.

PRODUCTION HINTS

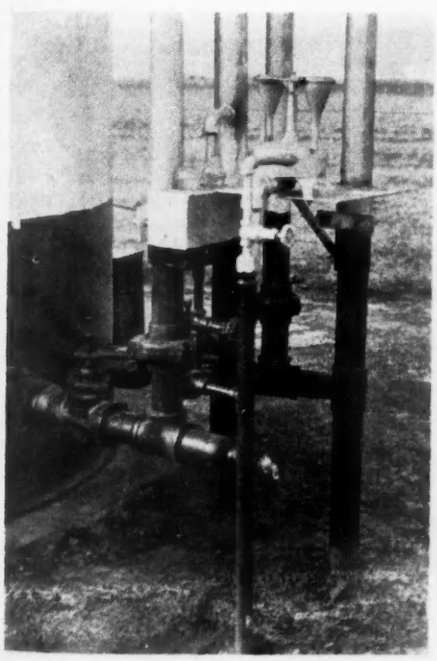
HOW TO—

Warm Crude Samples

A convenient mounting for the centrifuge used to check the sediment and water content of a crude oil may be constructed on the risers which are connected to the treater. The centrifuge may be powered by gas from the treater fuel system, thus reducing the amount of piping necessary for this particular location.

Primary advantage of placing the centrifuge near the heater is the availability of hot water which is used to heat the samples in the graduated flasks before making the shakeout test. Preheating the fluid sample may be accomplished by means of a small metal container in which to pour the hot water. The small box shown was made from thin sheet metal with two holes cut in the top side to accommodate the two graduated flasks.

The salt water container is held in place by a metal clamp which fastens to a riser near the treater. A half-inch line is connected from the bottom of the container to the salt water discharge line in the treater. Prior to making a shakeout test, the container is filled with hot water. Each graduated test flask is filled with proportionate amounts of crude and a small amount of emulsion treating chemical. The flasks are placed in the receiver holes of the container until the samples are warm. Both flasks are set in the centrifuge and whirled by means of gas pressure.



Here's the bit for FOREIGN EXPLORATION

For your exploration work in foreign areas, you will want to use Hawthorne Bits because they make drilling so much easier and more economical.

You need fewer bits to do the job. This simplifies your supply problem and saves considerable money.

Skilled bit dressers are no longer required. Your drillers renew the bit simply by replacing the blades at the drill with commonly available tools.

Patents Pending

You get tremendously increased footage in less time per set of blades. This speeds up drilling and cuts drilling costs.

Since Hawthorne "Rock Cutter" Blades successfully drill many formations that formerly required roller bits—bit costs and round trips are further reduced.

We will be glad to tell you more about Hawthorne Bits — just write us for more information — or better yet, order Hawthorne Bits for one of your drills right away and find out for yourself how well they perform.

HERB J. HAWTHORNE INC.

P. O. BOX 7299 HOUSTON 8, TEXAS

WAIT
LET US SHOW You

HOW SAND-BANUM Cuts Maintenance Costs

Sand-Banum automatically and safely removes and prevents boiler scale and corrosion. The resultant clean heat-transfer surfaces materially reduce fuel bills, increase efficiency and extend equipment life.

Sand-Banum comes in 16 oz. cans, all active ingredients, all ready to use as is. No mixing needed and no special equipment. It is so convenient, safe, simple and certain.

Sand-Banum has faithfully served power plants throughout the world for more than two decades. It seeks the privilege of similarly serving you. You will find it profitable to write for the facts.

"The Entirely Different Boiler and Engine Treatment"

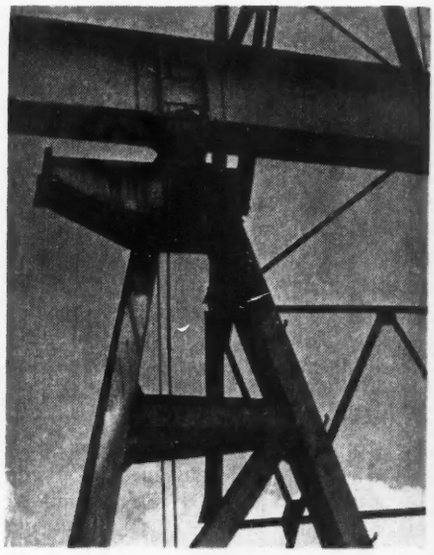
AMERICAN SAND-BANUM COMPANY, Inc.
9 ROCKEFELLER PLAZA,
NEW YORK CITY 20

HOW TO—Lubricate Beam Rocker Bearings

A few fittings and some short sections of quarter-inch pipe enable one operator to lubricate the beam rocker bearings from the ground instead of climbing the A-frame to the grease fittings there.

The grease fitting at the top of the bearing housing is removed, a short nipple put in its place, and a tee made up so as to parallel the beam. Another nipple and an ell take the drop leg of the line, which is wired to the A-frame and carries a pressure grease fitting at its end, just below the lower horizontal member of the A-frame. By attaching the grease gun to the fitting on the pipe extension, the pump can be operated on the ground, and lubricant forced to the elevated bearing.

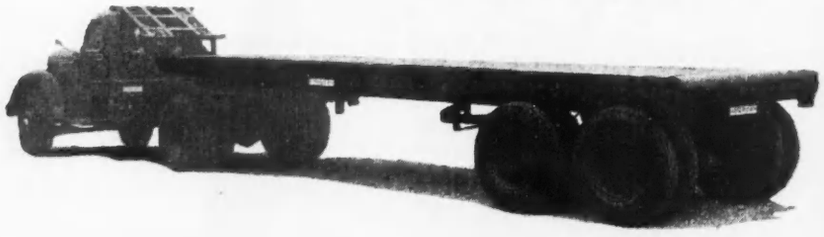
The end of the tee which does not carry the drop extension is fitted with another pressure gun fitting, so that lubricant can be applied at this point in case the extension becomes clogged for any reason.



On an Oil Field Trailer . . .

"A-M-E-R-I-C-A-N"

Spells DEPENDABILITY!



Behind the American nameplate is a quarter-century of experience in building a complete line of sturdy, dependable oil field trailers—both platform and pole models, of single and tandem axle design. The model SF-42-T nose-loading tandem shown here is an example of American-built platform trailers—designed, engineered and constructed to meet the most rugged hauling tests of the oil industry. We can give fast delivery on these versatile, economically-operated trailers. Let us know your requirements TODAY.

AMERICAN BODY and TRAILER INC.

Main Office—
OKLAHOMA CITY
1500 EXCHANGE AVE.

TULSA, OKLA.
5700 E. ADMIRAL PLACE

Branch Offices—
NORTH LITTLE ROCK, ARK.
3131 EAST BROADWAY

AMARILLO, TEXAS
740 NORTH GRAND

Automatic Control of Natural Gas Lines

By W. A. BREWSTER
Arkansas-Louisiana Gas Company

IN THE OPERATION of any natural gas pipe line system the gas dispatcher plays an indispensable role. He is charged with the responsibility of assuring that the right quantity of gas at required pressure is always available at the points of consumption along the entire system. In order to enable him to perform his duties efficiently and economically he must have available the means for safe and effective automatic control along the entire system. This article discusses practical uses and installations of such controls.

MANY companies manufacture controls today designed specifically for the gas industry. Each makes several different types of controls in a wide variation of pressure ranges that may be had in different styles cases, or even built as an integral part of the regulator or meter itself. Thus it might be well to bear in mind that this article is dealing primarily only with those controls and accessories which are adaptable to safe pipe line use. These are listed as follows.

1. Indicating pressure controller.
2. Recording pressure controller. (Same principle of operation.)
3. Differential controller.
4. Differential limit controller.
5. Pressure limit controller.
6. Remote controls {Electric / Pilot-loaded.
7. Pressure booster.
8. Pilot-loaded regulators.

Most controls are referred to as being "direct-acting" or reverse-acting." Unfortunately all manufacturers do not use the above terms to mean the same thing in regard to the operating principle of the control. To simplify the discussion and sketches used in this article the term "direct-acting" control will be used to denote a control that increases the pressure to the diaphragm motor lever with an increase of the controlled pressure. A "reverse-acting" control will decrease the pressure to the diaphragm motor lever with an increase of the controlled pressure.

Indicating and recording pressure controllers have the same principle of operation and are used for maintaining a constant pressure either upstream or downstream from the regulator. The indicating type control merely indicates the controlled pressure on a pressure gauge, or by means of a pointer on a graduated pressure scale. The recording type control uses a pen arm attached to the pressure element and records the controlled pressure on a clock-driven chart.

A differential control is used to operate a regulator in such a manner that the amount of gas passing will give a constant differential across an orifice plate which is directly upstream, or downstream, from the regulator. Since an orifice meter, capable of correct measurement, is an integral part of the control, the controlling mechanism is built directly into the orifice meter case.

The differential limit controller is for use in parallel meter installations and its function is to open and close a diaphragm-operated valve. It automatically permits flow through a second line when the rate of flow through the primary line exceeds the capacity of the meter in the primary line. It also automatically prevents flow through the secondary line when the rate is less than that which can be measured accurately by the meters in the two lines.

The pressure limit control might be described as two alternate working, snap-acting controls combined in one case. One control opens a motor valve at the minimum pressure setting and the other control closes the motor valve at the maximum pressure setting. For example, pressure range of an instrument is 0-500 pounds. Lower pressure limit set by indicator at 200 pounds, maximum pressure limit set by second indicator at 300 pounds. As long as the pressure to the pressure element in the control is above the lower limit of 200 pounds the motor valve would be kept closed. When the controlled pressure drops to 200 pounds, the control will open the motor valve to the wide open position. Regardless of pressure variations, the motor valve will then be kept open until the controlled pressure reaches the upper pressure limit of 300 pounds. When this upper pressure limit is reached the control will close the motor valve.

Electric remote controls are used to maintain a constant pressure at a point on a line several miles from the regulator by transmitting the pressure at the desired control point back to the control, which in turn operates the regulator. The complete control is composed of three parts: the transmitter, the receiver, and a two-wire circuit with a source of electrical power. The receiver is installed adjacent to the regulator and receives the controlled pressure from the transmitter located at the control point. The controlling mechanism in the receiver operates as an indicating or recording pressure controller.

Use of Remote Control

Remote control can be used on any single pilot regulator auxiliary control. The pressure being controlled is the upstream, or downstream pressure on the regulator in the line. The small pilot regulator may be removed as far from the line regulator as is deemed advisable for good operation. If air, or gas, at a pressure higher than the pressure being controlled is available at the location of the pilot regulator, only one line (¼-inch or ½-inch pipe) is necessary between the pilot regulator and the regulator being controlled on the line. The bleed to atmosphere should be installed near the pilot regulator for speed and accuracy of operation.

A pressure booster is a control that is built to operate a regulator by means

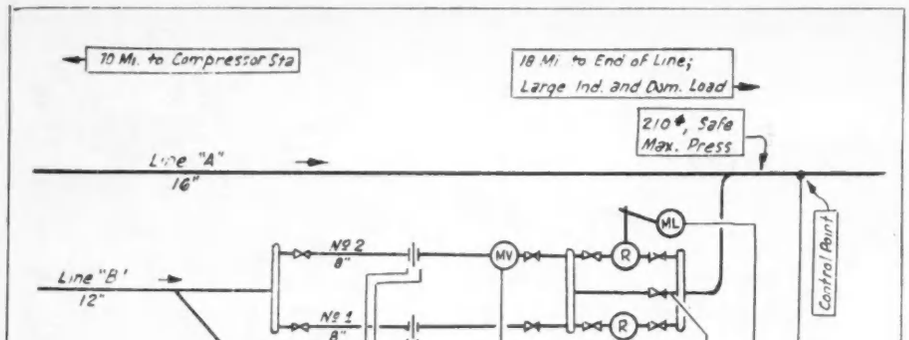


FIGURE 1

of a diaphragm motor lever, or as an integral part of the regulator. It is designed to maintain a reasonably constant pressure at a point on the line distantly downstream from the regulator. In operation the control raises (or boosts) the pressure immediately downstream of the regulator in proportion to the increase of load through the regulator. This increase of pressure at the downstream of the regulator is to balance the line drop, or friction, between the regulator and the designated control point on the line. For best results their use is usually confined to short lines (ten miles or less) that have most of the load at or near the end. They have proven successful, however, on lines 50 and 60 miles long.

The words "pilot controlled regulators" stand for a wide variation of designs and techniques. Different types of pilots under trade names are manufactured by several companies. Other companies build the pilot as a functional part of the regulator. In addition to the above, there are the so-called "home made" type pilots. For pipe line operation, pilot loading is safe only when a portion of the load is controlled by the pilot.

Diaphragm motor levers are a part of most automatic control settings on the pipe line. The motor lever is operated by pressure from the control to its diaphragm, and is the means by which the control operates the regulator. There are two types: (1) pressure to the diaphragm causes the lever arm to rise, (2) pressure to the diaphragm causes the lever arm to lower. In both cases the movement of the diaphragm is opposed by a compression spring. Diaphragm sizes vary from six-inch to 12-inch, but sizes under ten-inch should be avoided for pipe line controlling.

A safety drop-out or disengaging weight device is necessary in some control settings. Its safety features alone should make it a part of every control setting where it can be properly used. It is merely a device that hangs from the arm of the diaphragm motor lever and adds weight to the regulator lever arm. In cases of control failure, where the full control pressure is applied to the motor diaphragm, the drop-out device lifts clear of the regulator lever arm and leaves the regulator operating at a pressure slightly above or below the desired line pressure.

Installation

For satisfactory results the control instrument must be mounted level and as rigidly as possible. If the regulator setting is in a well constructed house, the instrument may be mounted on a wall panel or on a post of two-inch pipe set in concrete in the floor. It should not be mounted on part of the regulator setting, meter setting, or post that the motor lever is mounted on. Vibrations in the regulator will affect the control mounted in these places, cause the instrument to jump, thus imposing additional vibration on the regulator and loss of efficient control.

The exception to the above mentioned mounting places is in station locations which have bad ground vibration, such as those near large compressor stations. Here a single stand in the ground is always bad. A careful inspection of all the possible mounting places may prove one location to be considerably better than the rest. Check the vibration at the different points under consideration by placing a shallow pan of water at each and watching for minimum disturbance of the water.

The motor lever should preferably be mounted on a four-inch pipe post. The post should be set vertically in the center of a two-foot diameter hole, three feet deep, and the hole then filled with tamped concrete. The post should be set so that the motor lever arm is at a right angle to the permanent desired position of the regulator lever arm and half way between the end of regulator arm and the nearest fulcrum point. The motor lever arm should extend past the arm of the regulator about four inches. By rotating the motor lever on the four-inch post it is possible to connect its lever arm to any point on the regulator lever arm. If the motor lever is placed to operate above the regulator, about two feet of space should be allowed between the two lever arms when they are both in a raised position. This will allow ample space for the safety drop-out device. If the motor lever is mounted below the regulator, the four-inch mounting post must have threads on the upper end. Then a four-inch line pipe coupling and an additional piece of pipe can easily be used to extend its length for mounting the motor lever higher if so desired at some future date. Always use chain or a small flexible

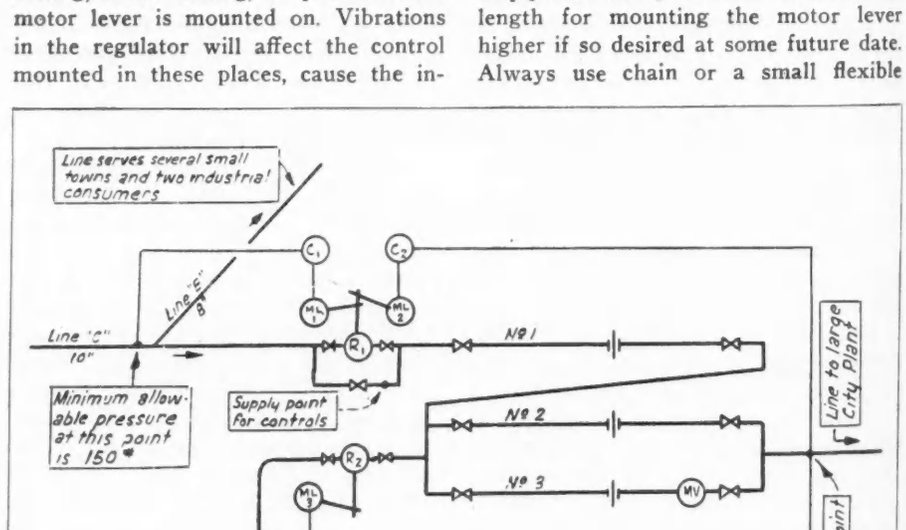


FIGURE 2

steel cable to connect the two lever arms, never a rigid connection.

Every control listed earlier in this article as being adaptable to automatic control of pipe line operations must have a supply of gas or air to operate on. With the exception of some of the types of controls which fall in the pilot-operated class, all the controls can be operated on a supply pressure of 25 pounds or under. Therefore, it would seem advisable to look to the downstream of the regulator for a supply point, for the lower the pressure the less trouble there will be from freezing. A ¼-inch valve on the regulator by-pass is a good supply point location due to the fact that it is dead gas and less apt to carry moisture in suspension. Install a small regulator at this point to reduce the line pressure to 100 pounds. If line pressure is already less than 100 pounds, only one regulator to reduce the pressure to 15-25 pounds will be needed directly ahead of the control. A strainer, or filter, should always be installed on the supply line before the gas or air enters the control. The primary purpose of the strainer is to eliminate dirt and scale, but it should also serve as a separator to trap small amounts of condensate. To protect the instrument from supply regulator failure, a small pop valve should be installed between the supply regulator and the control or a supply regulator used with the pop valve built in. Above all, the supply pressure to the control should be taken from a non-interruptible source.

The control point on the line, or in the station, is the point at which the control is expected to maintain the conditions for which it has been installed. The line from the control point to the instrument does not need to be larger than ¼-inch or ½-inch pipe, but should be free of leaks or constructions.

The control point should be selected wisely. If the problem is controlling upstream or downstream pressure on a regulator, the control point on the line should be located at least one joint of pipe away from the station itself. Differential controls, differential limit controls, and pressure boosters have as their control point taps on the upstream and downstream side of an orifice plate. They are the only controls which require two lines from control to the control point. The differential control and pressure booster may use an orifice plate installed away from the station, when the orifice plate is not necessary for measurement.

Figure 1 shows the practical use of the indicating pressure controller (C_2 and C_3) and the differential limit controller (C_1). Both of the pressure controllers are direct acting, have an operating range of 0 to 300 pounds, and are

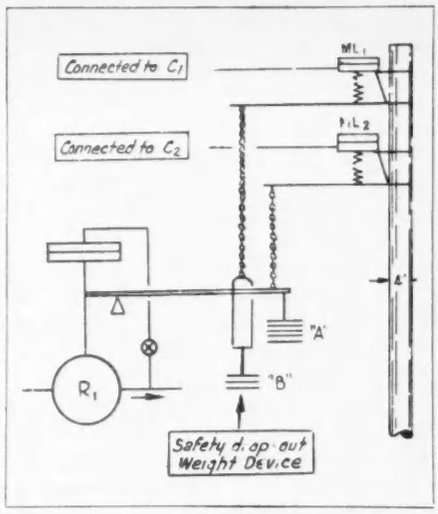


FIGURE 3

used to operate individual regulators by means of 11-inch motor levers mounted above the regulator lever arms. Safety drop-out weight devices are used in both cases.

Orifice Meters

Orifice meters are standard 0-100-inch 0-500 pounds. The differential limit control (C_1) has gauge lines separate from those used by the orifice meter and is connected to receive the differential across the orifice plate of the No. 1 meter run. The eight-inch motor valve is installed downstream of the orifice plate on meter run No. 2 and is opened and closed by the differential limit control (C_1).

The safe maximum pressure on line "A" at the control point is 210 pounds; the desired minimum is 190 pounds. The pressure on this line pulls down rapidly due to heavy load conditions 18 miles downstream of station. The pressure on line "B" varies between 250 pounds and 350 pounds, thus making a straight tie-in between the two lines impossible.

The regulators have enough weights on each lever arm to make them feed against a line pressure of about 170 pounds. The safety drop-out devices, when completely lowered, add enough additional weight to the regulator lever arms to cause the regulators to feed against a line pressure of about 210 pounds. Both regulators are balanced to feed approximately the same volume of gas at all loads and both pressure controllers are set as sensitive as possible for 190 pounds.

When only a small amount of gas is needed from line "B" the gas is measured through the No. 1 meter run. The differential limit control is set to open the motor valve on the No. 2 meter run when the differential on meter run No. 1 reaches 90 inches. Both meter runs then remain in service until the differential on both meter runs drops to ten inches, at which time the differential limit control closes the motor valve and all gas passing is measured on No. 1 meter run.

Figure 2 shows two ten-inch lines (C and D) supplying a large city plant. It is desired to supply as much of this city plant load as possible off of line "C." The eight-inch line "E" comes off line "C" and goes on to supply several small towns and two industrial consumers. In order to have gas available at sufficient pressure to supply the load on line "E," the minimum desired pressure at the junction of line "C" and "E" has been set at 150 pounds. The safe maximum allowable pressure on line "C" is 250 pounds. The desired pressure on the line to the city plant is 80 to 81 pounds.

Control C_2 is a direct-acting pressure controller, range 0-100 pounds. It operates the regulator R_1 by means of an 11-inch motor lever. The control is set as sensitive as possible for controlling the pressure on the city plant at 81 pounds. Control C_3 is a direct-acting pressure controller, range 0-100 pounds. It operates the regulator R_2 by means of an 11-inch motor lever. The control is set as sensitive as possible for controlling the pressure on the city plant at 80.5 pounds. Control C_1 is an indirect

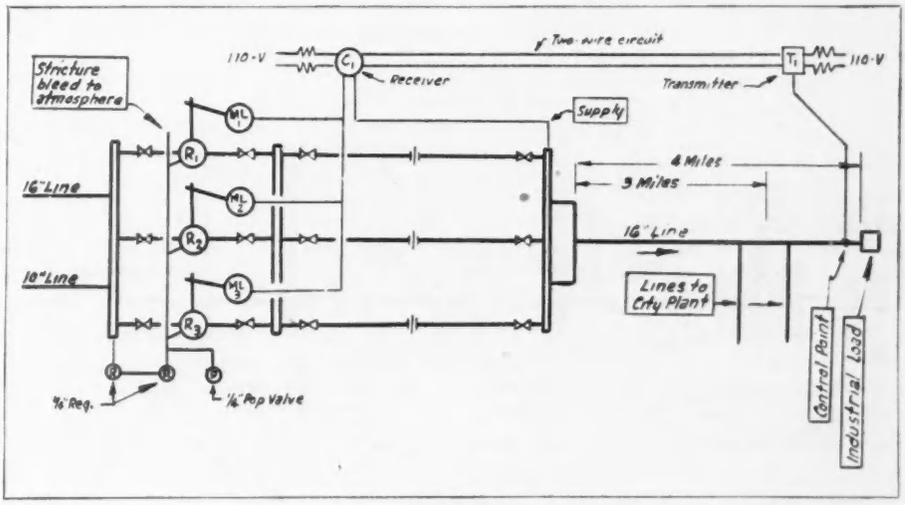


FIGURE 4

acting pressure controller, range 0-300 pounds. It operates the regular R_1 by means of an 11-inch motor lever and safety drop-out device. It is set as sensitive as possible for controlling the pressure on line "C" at 150 pounds.

The two motor levers (ML_1 and ML_2) are connected to the regulator R_1 as shown in Figure 3. The weight 'A' on the regulator arm will cause the regulator to feed gas into the city plant at 70 pounds. Weight (A plus B) will cause the regulator to feed gas into the city plant at 90 pounds. Thus control C_2, by means of its motor lever, must lift part of the weight on the regulator lever arm to control city plant pressure at 81 lbs.

As the pressure on line "C" pulls down to 150 pounds, control C_1 goes into service, supplies pressure to its motor lever, and begins to raise the weight 'B'. Weight 'A' alone on the regulator lever arm is not sufficient to make the regulator feed against 81 pounds. Thus as weight 'B' is raised, the volume of gas through the regulator R_1 is cut back so that the amount of gas passing will not pull the pressure on line "C" below 150 pounds. As control C_1 decreases the volume of gas through the regulator R_1, the pressure to the city plant begins to drop. Control C_2 bleeds the pressure on motor lever ML_2 to zero, its lever arm drops, and the chain between the motor lever arm and the regulator arm becomes slack.

When the city plant pressure drops to 80.5 pounds, control C_2 goes into service and controls city plant pressure with gas from line "D" fed through regulator R_2.

Figure 4 shows an electric remote control which consists of three parts: the transmitter (T), the receiver (C_1), and a two-way circuit with a source of electrical power. The receiver is reverse acting; range is 0-25 pounds. The receiver controls the performance of the three regulators (R_1, R_2, and R_3) by means of three 11-inch motor levers (ML_1, ML_2, and ML_3). The motor levers are mounted below the lever arms of the regulators and are the type that pressure to the diaphragm causes the lever arm to move downward. The lever arms of the regulators are unweighted. The regulators (R_1, $_2$, $_3$) are closed by means of a ¼-inch pilot regulator with a small bleed to atmosphere. The pilot pressure to the head of the regulators is 20 pounds. Each of the three large regulators have seven-inch heads. The desired pressure is 20 pounds.

The load variations at the control point are so wide that the pressure on the meter runs must be varied from 24 pounds to 60 pounds in order to maintain 20 ± 1 pounds at the control point. This wide variation in pressure on the downstream of the regulator makes the use of the standard diaphragm piping to the regulator head impracticable with this type of control.

Safety Factor

The safety factor in the control problem shown in Figure 4 is not very good, because control failure either closes the regulators or causes them to fall wide open. However, there are available controls of this type that automatically switch to pilot feed on the regulator when control failure occurs. The pilot maintains the pressure on the downstream of the regulator constant at the pressure at the time of control failure. The station shown is not equipped with this additional control equipment because a station attendant is necessary 24 hours a day for reporting line pressure and other duties.

Remote controls are in service where the control point is 30 or 40 miles from the control and regulators. Each control setting is a problem that has to be worked out in regard to time-lag and sensitivity of adjustment.

Figure 5 shows a pipe line setting whose emergency value is made possible by a pressure limit controller. The city plant shown in the sketch is furnished gas by means of a 12-inch pipe line owned by company 'A.' The line owned by company 'A' is large enough and carries sufficient pressure to supply all the gas needed by the city plant. However, due to a rather dangerous river crossing, it was thought best by company 'A' to have a stand-by source of gas available in cases of emergency. Company 'B' has a 24-inch pipe line passing within six miles of the town and is willing to sell company 'A' gas during an emergency.

The pressure on the city plant is 20 pounds. Regulator (R_1) is operated by means of a direct acting, 0-50-pound, control (C_1) and motor lever (ML_1). The control is set to feed gas through the regulator (R_1) when the city plant pressure drops to 15 pounds.

Control (C_2) is a direct-acting, 0-300-pound, pressure controller set to operate regulator (R_2) by means of motor lever (ML_2). The control (C_2) is set to maintain the pressure downstream of the regulator (R_2) at 90 pounds.

Control (C_3) is a pressure limit controller, range 0-150 pounds. the lower limit is set by indicator at 91 pounds, the high limit is set at 94 pounds. The control operates the motor valve flanged directly upstream of regulator (R_3). When the pressure on the ten-inch line pulls down to 91 pounds the control (C_3) opens the motor valve (MV) to the wide open position. Thus the line pressure of the 24-inch line is behind the regulator (R_2) when it starts to feed gas into the ten-inch line. The gas passing will be measured on the meter run shown in the sketch.

The small high pressure positive meter and the small regulator are a necessary part of this installation. The small regulator is very sensitive and set at 100 pounds. When company 'A' can supply the city plant, the regulators (R_1) and (R_2) will be closed by their respective controls. The regulator (R_3), however, will continue to feed a small amount of gas in to the ten-inch line until the pressure remains constant at 100 pounds. When the small regulator (R_3) builds the pressure up to 94 pounds the limit control (C_3) will close the motor valve, which is a positive shut-off. Any leakage through the regulator (R_1), or line leakage, will be measured on the positive meter. This small amount of gas could not be measured through the large meter runs.

The pressure limit controller can have many helpful uses in pipe line operations. A primary line can be allowed to feed into a secondary line while the pressure on the secondary line is between certain limits of pressure. Motor valves on lines such as river crossings can be automatically closed when breaks occur.

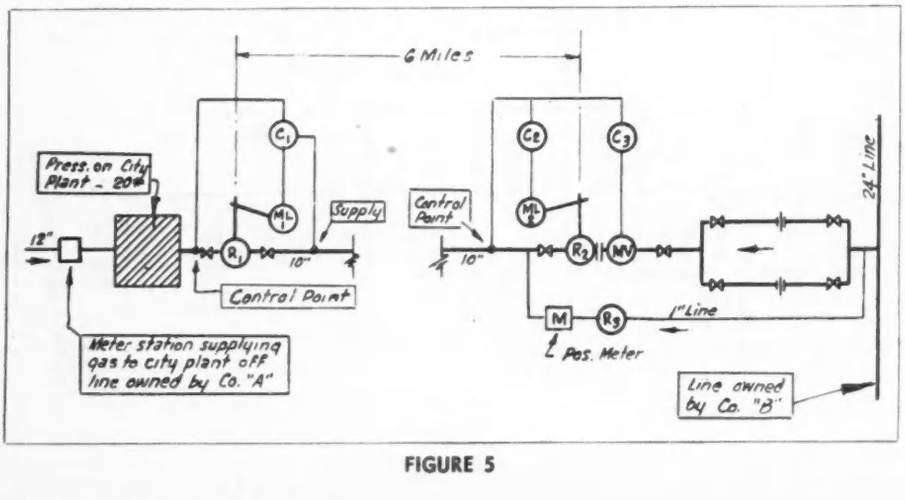
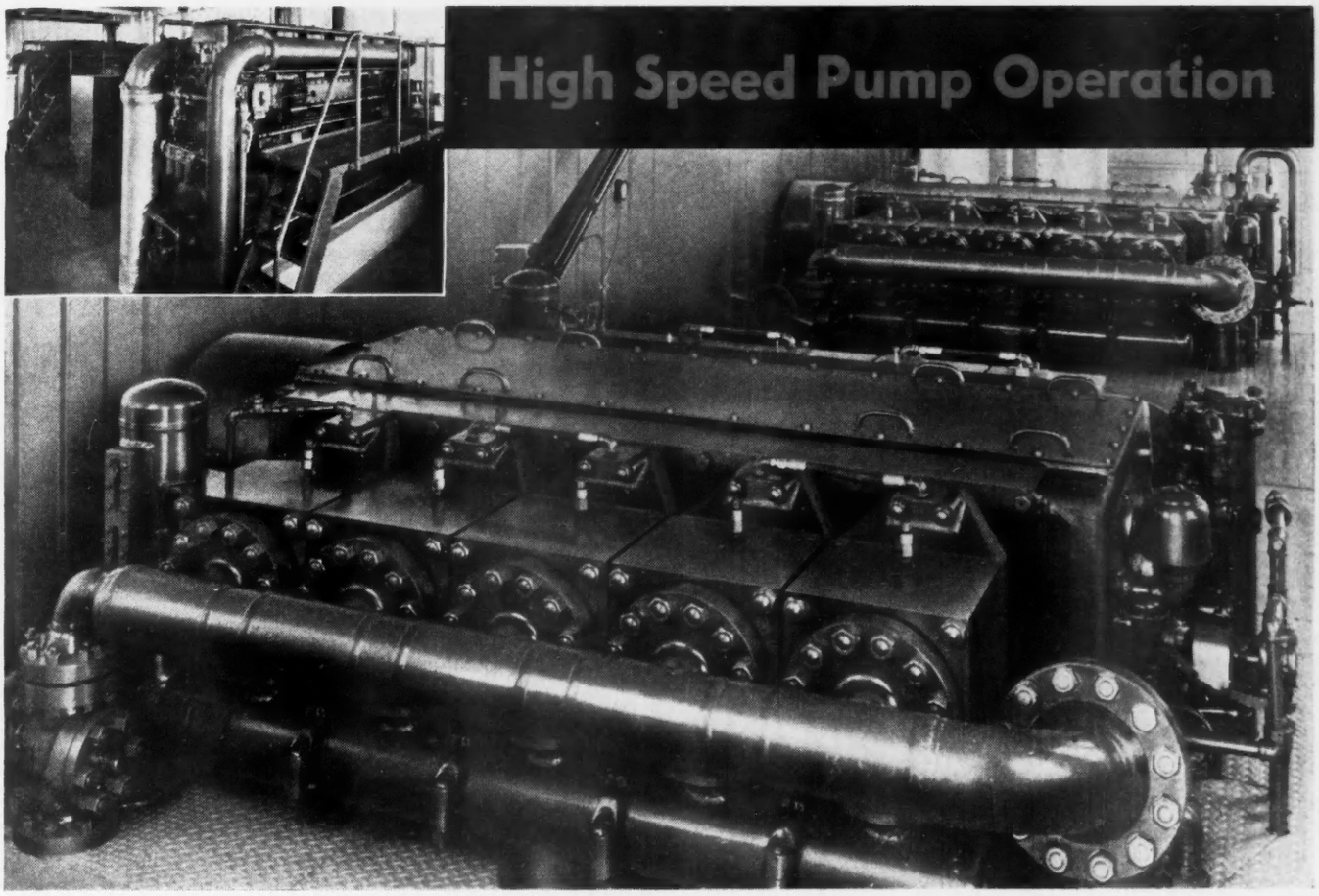


FIGURE 5

ACKNOWLEDGEMENT

The author thanks the Publications Committee of Southwestern Gas Measurement Short Course for permission to publish the above article.

High Speed Pump Operation



High speed horizontal "twin quintuplex" ten-cylinder pumps built to operate at 400 revolutions per minute now in service at Utah Refining Company plant at Rangely, Colo. Engine is shown in insert.

By F. V. COOK
Master Mechanic, Stanolind Pipe Line Company

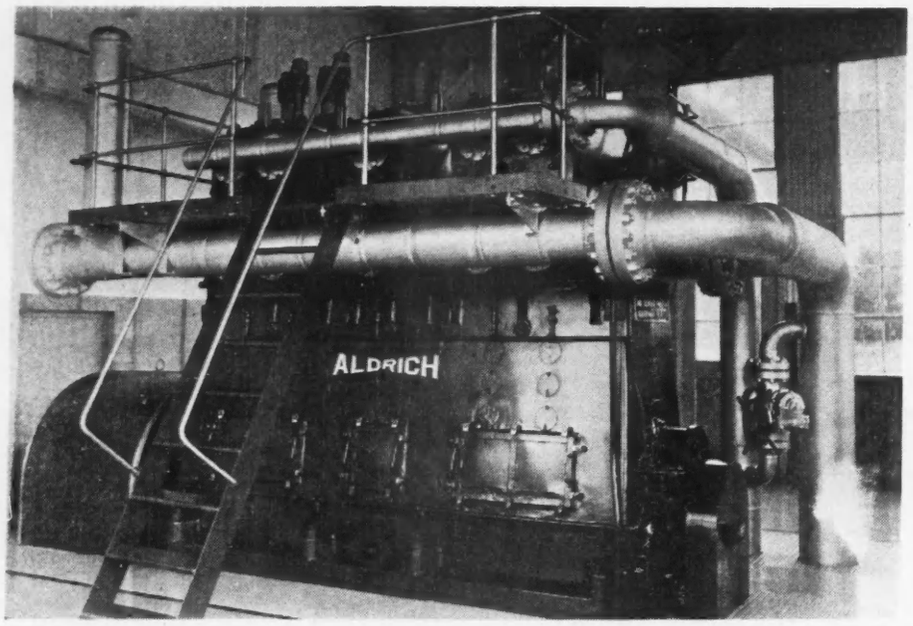
PIPELINERS have always talked about the time when someone would put a forged billet instead of cylinders on top of a Diesel engine crankcase to make a pipe line pump. During the year 1943, when it was almost impossible to purchase gears for pumps or for other civilian purposes, the Stanolind Pipe Line Company was offered such a pump for installation with a second-hand, 180 revolution-per-minute diesel engine. This pump, with ten-inch stroke, was built around a crankshaft identical to those that had previously been used in the conventional type vertical quintuplex pump, but the shaft was placed in the bedplate, thus making a so-called "inverted" pump, the pipeliner's dream of a steel billet on top of an engine crankcase.

This pump was installed at a station near Hillsboro, Texas, in February, 1944, and operation at speeds to 180 rpm has been entirely satisfactory, although it is noisy in comparison with the conventional slow-speed pumps. Total repairs during this period consisted of refacing a few of the stainless steel valves and seats and replacing a few of the porcelain plungers. While the speed of this pump was considered high by the pipe line industry, conventional pumps of this size had previously been run at equal speeds in hydraulic service in steel mills.

The successful operation of this first high speed pump has since led to the installation by Stanolind Pipe Line Company of 16 additional pumps. Six more are being installed and two additional twin quintuplex pumps have recently been ordered for operation at 375 rpm.

Two of the 16 pumps mentioned were horizontal "twin quintuplex," ten-cylinder pumps, built to operate at 400 rpm. These pumps, installed in the Utah Oil Refining Company plant at Rangely, Colo., in December, 1945, caused considerable trouble because valve operation was too slow, resulting in high shock pressures when the suction valves closed. These shock pressures caused many failures of the cast pump cylinders and severe vibration in the piping as far away as the manifold. After numerous failures, forged steel cylinders were designed and ordered for these two pumps. While awaiting delivery of the forged cylinders, the valve lift was decreased from ⅜-inch to ⅛-inch, permitting earlier closing of the valves, with the result that failures of the cast cylinders were eliminated during a period of 2½ months prior to receipt of the forged steel cylinders. Three cylinders had been broken in the 24 hours previous to changing the valve lift. The new cylinders, fitted with a synthetic resin instead of steel valves, were installed, and while they did not improve the volumetric efficiency by earlier closing of the valves, it was thought that the steel construction would prevent failures. This was

HIGH SPEED vertical reciprocating pumps, bringing marked weight and space requirement reductions over conventional horizontal types, have been tried and found practical. The author highlights the use of such pumps in the light of experimental installations on his system, and recommends types of application.

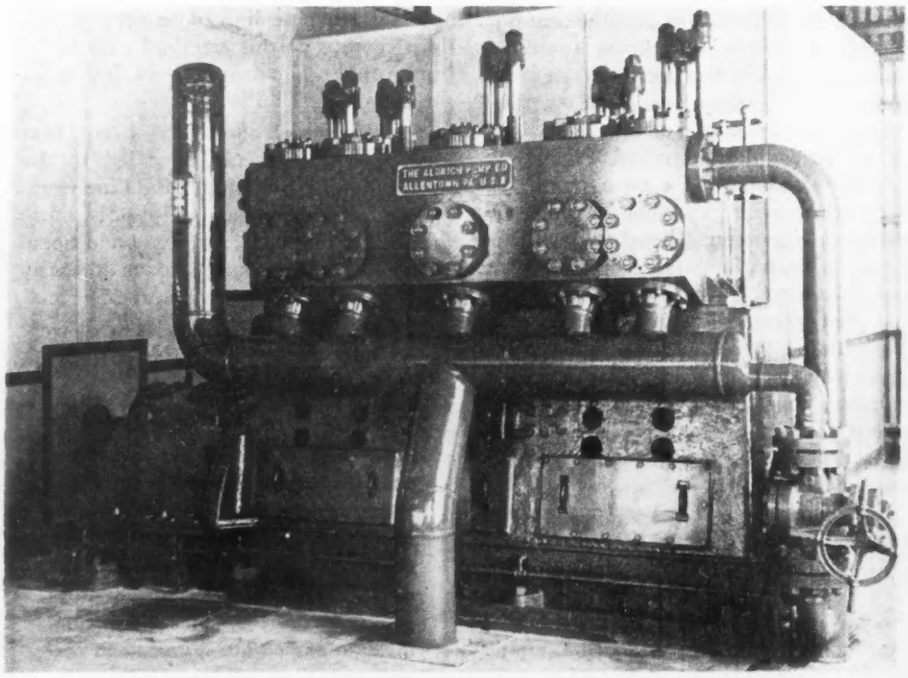


So-called inverted pump—the pipe-liner's dream of a steel billet on top of an engine crankshaft—installed near Hillsboro, Texas. This pump with ten-inch stroke, was built around a crankshaft identical to those previously used in the conventional type vertical quintuplex pump, but with the shaft placed in the bedplate.

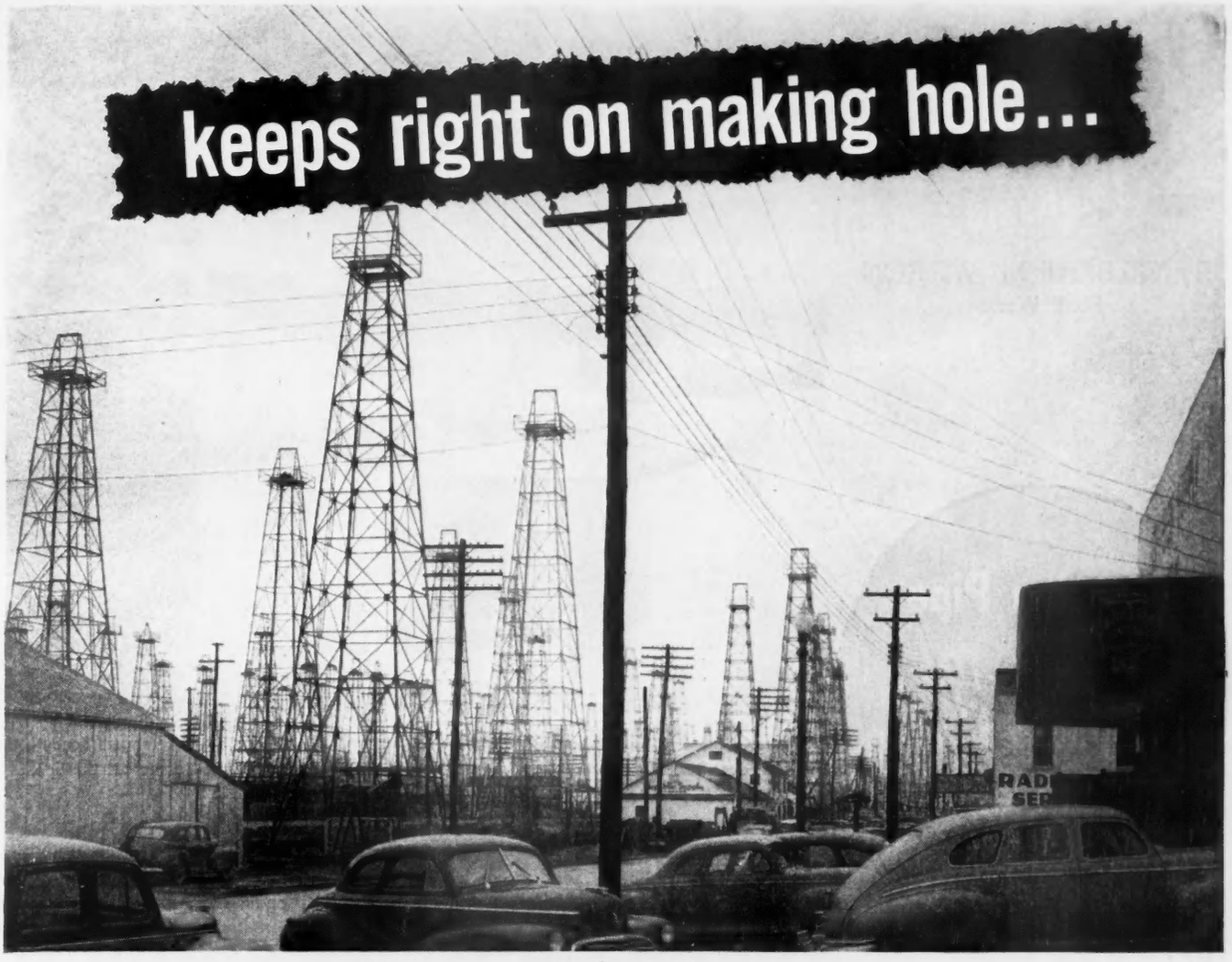
erroneous because the synthetic resin valves swelled in the cages, operating even less rapidly than the steel valves in the old cylinders, and caused failures in both piping and cylinders. Volumetric efficiency dropped from 85 percent to 75 percent in the few weeks before it was discovered that the valves were sticking open in the cages. In the meantime, experiments were being carried on with heavy springs and it was found that pressures of 20 pounds per square inch of valve area were required to close the valves as rapidly as necessary. The installation of compounded resin valves with increased clearance in the cages and the heavy springs resulted in immediately increasing the volumetric efficiency to 96 percent or better. No additional failures have occurred. These two units, each with a sea level rating of 420-horsepower at 330 rpm, were installed to handle 20,000 barrels per day at 1400 pounds pressure. The engines also were required to handle all auxiliaries and the generator load, and they were de-rated for 5200-foot elevation. The two units have since handled 28,000 barrels per day at 1500 pounds pressure at 340 rpm and 40,000 barrels per day at 1200 pounds pressure at 360 rpm. During periods when one unit was shut down the other has handled 1050 barrels per hour at 1200 pounds pressure, operating at 450 rpm.

Three of the 16 pumps previously mentioned are inverted quintuplex and are directly connected to 1350-horsepower engines to operate at 260 and 277 rpm. These have been noisy due to the use of the same heavy metal valves as were used in the original pump at 180 rpm. The volumetric efficiency has been satisfactory (95 percent when new), and no failures have occurred except those that resulted from improper design, operation, or material. The pumps were placed in service before the discharge lines were backfilled and anchored, resulting in vibration and failure of a few small pipe connections welded into the discharge lines. Most of these weak places in the piping have since been removed and failures practically eliminated. Several plunger failures resulted from defective workmanship in manufacture. These pumps have handled quantities ranging from 2000 barrels per hour at 1300 pounds pressure to 3000 barrels per hour at 900 pounds pressure. A set of synthetic resin valves placed in one of these pumps has eliminated a large part of the objectionable noise and has increased the volumetric efficiency about 3 percent over the metal valves that had been in service 14 months. The replacement valves have not been touched since installation except for inspection. The condition of these valves indicate that they will last indefinitely, and we are now endeavoring to obtain rubber-faced valves to eliminate the remainder of the noise.

From several years' experience it is possible to state that, in addition to pressurized suction which is deemed to be a necessary requirement, the operation of high speed pumps requires light weight valves with low lift, large area, and heavy springs, to insure rapid closing. While this experience has been a headache at times, it has been interesting and it is believed that it is a valuable contribution to the industry in promoting the use of equipment that will appreciably lower the manufacturing and installation costs of reciprocating pipeline pumps. As an example, a 400 rpm, four inch stroke twin quintuplex pump rated at 1200-horsepower weighs ten tons as compared with approximately 80 tons for an equal capacity horizontal duplex pump geared to operate at 50 to 60 rpm. The latter pump will require approximately 40-foot spacing of units in a building as compared with 20 feet or less for the high speed pumps. Foundation and other installation costs will be correspondingly lower for the high speed pump, which approaches the centrifugal pump installation in space requirements.



Eight-inch stroke pump driven at 175 rpm through single reduction gear by 600 rpm electric motor, operating at Kirby, Wyo.



WAUKESHA *Diesel Six*

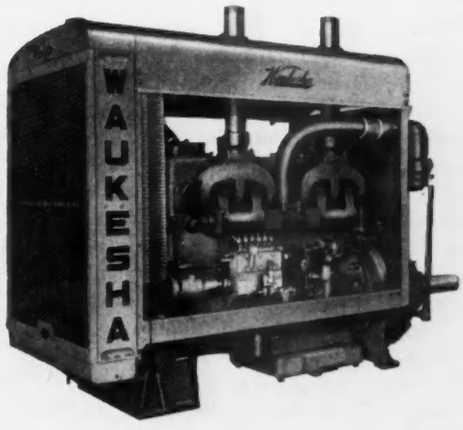
SUPER-DUTY OIL FIELD UNIT ★

... the postwar Diesel for deep drilling. Special Diesel design characteristics are combined with all the wartime-proved materials and features by Waukesha's 40 years' engine building know-how. The result is a super-duty six power plant that keeps your costs down while it keeps right on making hole.

Rugged and ready for heavy duty, yet fast, flexible and smooth—plus the same lively acceleration you have been getting with your gas engines. Easy starting, too ... even in cold weather ... with either the Waukesha gasoline starting engine or electric system.

Clean burning—for high fuel economy. Its patented Diesel combustion chamber, found only in Waukesha Diesels, burns all "high speed diesel fuels" with cetane values of 45 or above.

Operating on the four-cycle principle, its wet cylinder sleeves, precision bearings, simple overhead valve mechanism and other operating and maintenance features of familiar types make this Diesel easy to understand and to service. Send for Bulletin 1418.

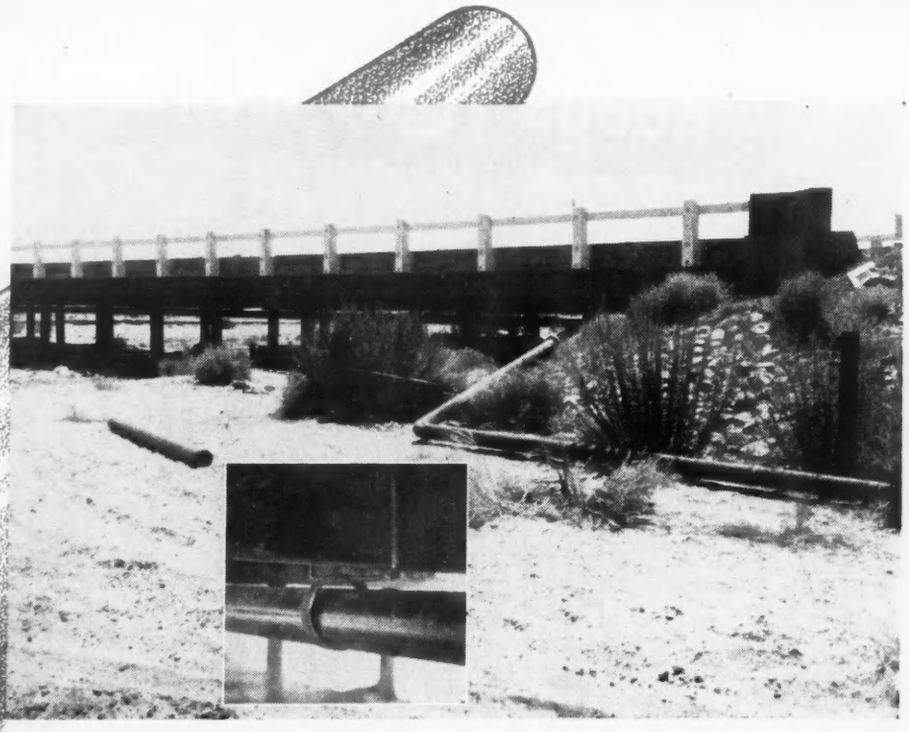


SUPER-DUTY DIESEL SIX (Model 6-WAKDU) **OIL FIELD POWER UNIT** six cyl. 6¼ in. bore x 6½ in. stroke, 1197 cu. in. displ., 190 hp. max. at 1300 rpm.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS., NEW YORK, TULSA, LOS ANGELES

Invasion Pipe *Solves* Cuyama Line Problem

By GILBERT M. WILSON
Staff Writer



Wherever possible, river crossings were made by hanging the pipe on special hangers beneath the bridge. Inset shows how sucker rod hangers, looped over bridge timbers, support the line.

WHAT to do when a new oil field of sizable proportions is being developed, daily crude production of from 2000 to 3000 barrels per day has to be run, the nearest pipe line connection is 33 miles distant, trucking costs are 35 cents per barrel, and delivery of line pipe necessary for a pipe line cannot be promised by the mills before some time in 1952—these were the problems faced by Richfield Oil Corporation in the early part of July when the company was beginning to expand drilling operations in its newly discovered Russell Ranch field in Cuyama Valley.

To the credit of company engineers and the several contracting firms performing the work in the field, a crude oil line was built despite the obstacles presented. A temporary line was laid using for about three-fourths of the distance, light-walled, 20-foot lengths of six-inch war surplus invasion pipe, and utilizing for much of the line the quick-assembling couplings with which such pipe normally is coupled. The 33-mile line was completed in 14 days, with an additional 12 days being taken for testing and welding a nine-mile section on the slope of the 3000-foot range of mountains traversed by the line.

For the greater part of the distance, the line was strung along on the surface of the ground, beside fences bordering the highway, between crop plantings in agricultural areas, slung on loops beneath bridges, and swung across shallow ravines and gullies. Exceptions to this were the several intervals where ditching was necessary, such as the six-mile stretch where it ran on state highway property; at road crossings; or where the ground was wet due to irrigation. In such instances, the pipe was welded, primed, asphalt-coated, and lowered into a shallow ditch.

Where pipe was strung across gullies, or where turns in excess of about five degrees were made, joints were welded together. In addition, on either side of the eight six-inch block gates placed at intervals along the line, a joint of standard weight line pipe was welded into the line. Wherever possible, loops were put in the line to allow ample room for expansion and contraction. Provision for cathodic protection also had to be made at several points along the route. As major segments of the pipe line were completed, they were tested for leaks with water pressur, using a portable, gasoline engine powered trailer mounted pump.

Three Spreads

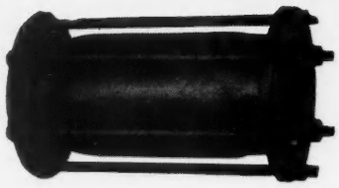
With the exception of the several miles of extensive road building and clearing work required on the summit of the range of mountains crossed by the right of way, laying of the line presented few major problems other than the precautions that had to be taken in handling the light pipe. Three spreads, each consisting of from five to seven men, were in the field. In certain areas a spread would be equipped with portable arc-welding equipment, another would have ditching and coating equipment, while in other areas, principally along the more level stretches of terrain, a crew might be equipped with only hand tools, speed wrenches and a supply of couplings used in making up the joints.

Single, 20-foot joints ordinarily could be handled easily by one or two men if necessary, two men generally being required to make up a coupling and another man or two bringing up blocks, tools, and coupling parts. One of the principal problems in the handling of the light pipe was in seeing that ends were not injured or bent out of round while being unloaded from trucks or being strung along the right of way. To facilitate stringing in some sections, particularly on steep slopes or unusually rough terrain, where alignment and welding problems existed, two and three joints were welded together at a centralized point, then carried or dragged into position on the right of way.

Nine miles of the line, that portion nearest the field and where line pressures were the highest, is Navy type invasion pipe having a wall thickness of 0.22 inch. Beyond the nine-mile point, Army invasion pipe having a wall thick-

Convenient!

you can buy these products through these Companies

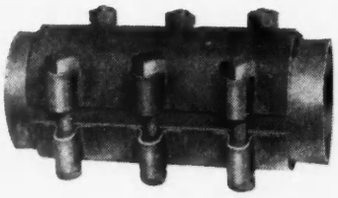


DRESSER LONG SLEEVES

(Style 40) simplify pipe joining. Span gaps between pipe ends. No threading, exact fitting or aligning. Ideal joint at wells, separators, pumps, engines and tanks.

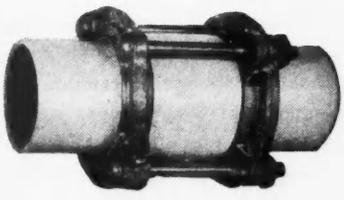
DRESSER COUPLINGS

(Style 38) speed laying of field, gathering and transmission lines; save time on hookups; absorb vibration at pumps, engines and compressors. 100% salvageable in relocating temporary lines.



DRESSER SPLIT REPAIR CLAMPS

(Style 79B) for quick repair of pitholes and longitudinal splits in pipe. Furnished with either one or two shells—an inexpensive "bandage" which saves cutting out short sections of damaged pipe.



DRESSER COLLAR CLAMPS

(Style 4,41) stop leaks through threads of screw collars, without service interruption. Band Clamps (Style 77B), Porous Weld Clamps (Style 55), and other pipe repair devices also available.

(Partial List)

Alamo Iron Works
American Pipe & Supply Co.
American Supply Co.
Arrow Supply Co., Inc.
Banks-Miller Supply Co.
Bethlehem Supply Co.
F. W. Black
Bluefield Supply Co.
Bovaird & Co.
Bovaird & Seyfang Mfg. Co.
The Bovaird Supply Co.
Bradford Supply Co.
Briggs-Weaver Machinery Co.
Brown-Strauss Corp.
The Cameron & Barkley Co.
Capitol City Supply Co.
Cen-Tex Supply Co.
Clowe & Cowan, Inc.
Continental Supply Co.
Crane Co.
Dunigan Tool & Supply Co., Inc.
Federal Oil Field Supply Co.
Federal Supply & Machine Co., Inc.
Franklin Supply Co.
French Tool & Supply Co.
Frick & Lindsay Company
General Oil Field Supply Co., Inc.
Greenhead Bit & Supply Co.
Grinnell Co.
Houston Oil Field Material Co., Inc.
Howard Supply Co.
Industrial Supply Co.
International Derrick & Equipment Co.
Iverson Supply Co.
Jarecki Manufacturing Co.
Jones & Laughlin Supply Co.
Lloyd-Smith Co.
Louisiana Supply Co.
The McJunkin Supply Co., Inc.
Mid-Continent Supply Co.
Midland Supply Co., Inc.
Morrison Supply Co.
Mountain Iron & Supply Co.
Murray-Brooks Hardware Co., Ltd.
Murray Tool & Supply Co.
The National Supply Co.
Norvell-Wilder Supply Co.
Oil Well Supply Co.
Parkersburg Rig & Reel Co.
The Peerless Supply Co., Inc.
Pelican Well Tool & Supply Co.
Producers Supply & Tool Co.
Republic Supply Co.
Republic Supply Co. of California
Rodman Supply Co.
San Antonio Machine & Supply Co.
Standard Supply & Hardware Co., Inc.
Superior Iron Works & Supply Co., Inc.
United Supply & Mfg. Co.
Weaks Supply Co., Ltd.
Well Machinery & Supply Co., Inc.
Western Supply Co.
Wilson Supply Co.
Zanesville Tool & Supply Co.

Always within "hollering distance"

at your nearest oil field supply store or our Houston Warehouse, Dresser products save installation time and give you *reliable* connections and repairs.

DRESSER COUPLINGS and Repair Products

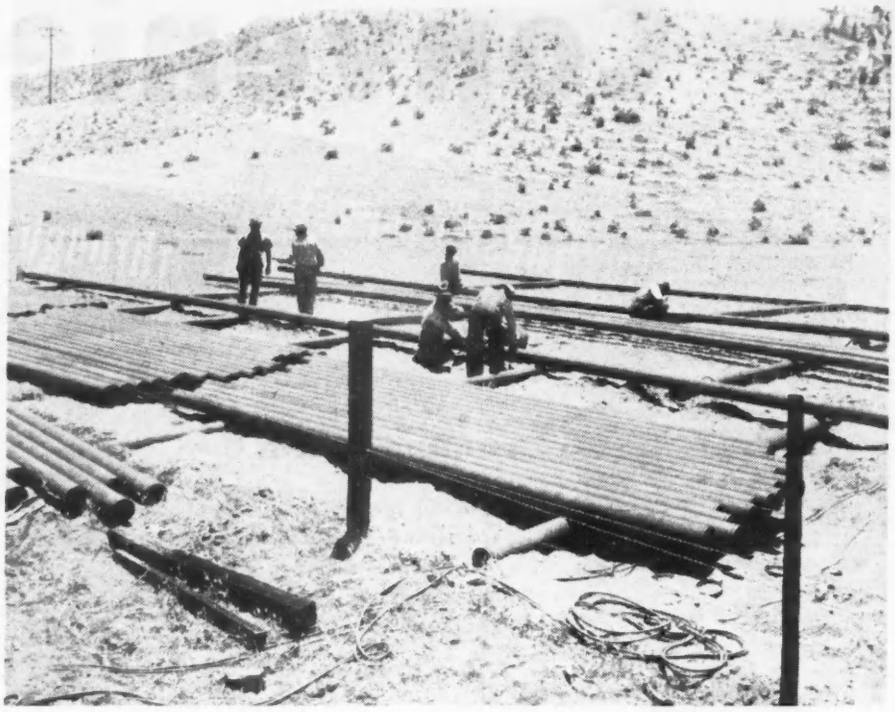
Dresser Manufacturing Division (One of the Dresser Industries), 59 Fisher Ave., Bradford, Pa. • Houston Office & Warehouse: 1121 Rothwell Street, Houston, Texas. • Sales Offices: New York, Chicago, Houston, San Francisco.

ness of 0.125 inch was used, an exception being the last 9½ miles of the line where new five-inch welded pipe of 0.125 inch wall thickness was employed.

Gravity Flow From Summit

The line was designed to take maximum advantage of the topography traversed between the field and the Lake Station Terminus. Elevation of the field area is approximately 2100 feet and that of the Lake Station about 400 feet, the 3000-foot summit being situated about 15 miles distant from the starting point. Line pressure gradients were calculated so that, starting out with an initial pressure of 925 pounds per square inch, pressure would be reduced to about 600 pounds at the point where the lighter 0.125 wall thickness pipe commenced. From there on to the summit, friction and increasing elevation would reduce pressure to somewhere between 25 pounds and zero. From the summit on down to the Lake Station tank farm, a distance of about 18 miles, the oil flows by gravity.

Ultimate capacity of the line is approximately 10,000 barrels per day, operating at the designed pressure of 925 pounds per square inch at the input end. If necessary, however, this could be increased to about 16,000 barrels per day by addition of a booster pump station near the summit. Although current total production from the field is considerably less than its capacity, the line is being operated continuously at a reduced rate in order to hold to a minimum difficulties that might result from expansion and contraction if the line were operated only at intervals. Since most of the line lies directly on top of the ground with little or no covering, it is more vulnerable to stresses set up by extremes of daytime and night time temperature changes. It is not expected that winter weather will present any problem, the gravity of the oil being comparatively light, ranging from 33 to 37 degrees API.

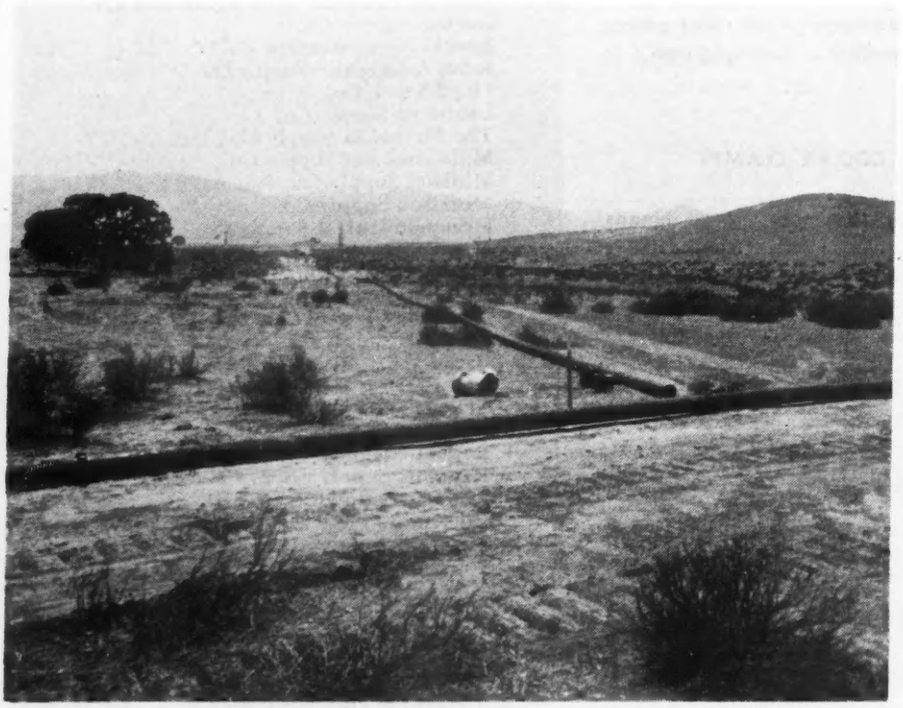


To simplify welding along rougher portions of the right-of-way, a centralized station was set up where joints were joined to make 60-foot lengths, after which they were taken out to be welded into the line.

At this writing a total of 11 wells have been completed in the Whiterock and Russell areas of the new field (WORLD OIL, August, 1948, page 87) which currently are producing a total of slightly more than 4000 barrels per day. From 12 to 15 drilling rigs are running in the area.

At the present time there are three pump stations in the field, one located on the Russell portion of the field, and the other two located in the Whiterock sector. Pumps are conventional 4 x 10 duplex installations powered by multi-cylinder gas engines.

The completed line, considering the relatively short time required for its construction and the problems presented by the terrain and light weight pipe, represents another example of what can be done by the pipelining fraternity when an emergency arises, material shortages notwithstanding. In the present instance, the temporary line will serve the needs of the new field until such time as development work demonstrates what size pipe will be required for the permanent line. In the meantime, the present line, which incidentally is expected to pay for itself within less than a year by elimination of trucking costs, will handle the expected production from the field until delivery of new pipe is made.

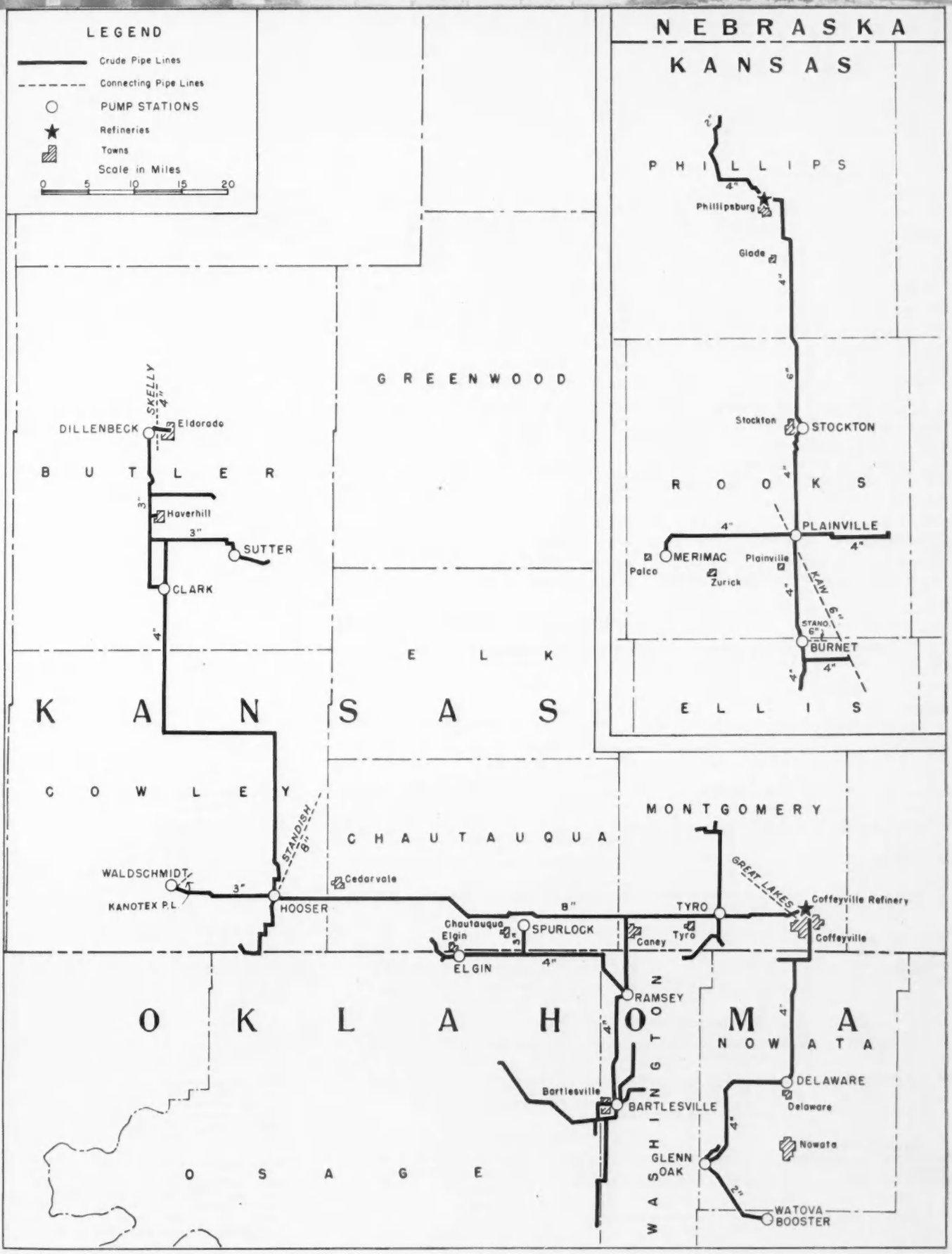


Junction of Russell area lateral with main line. Russell area, in distance, is slightly over two miles southeast of Whiterock area.

Pipe Lines of the U.S.

Cooperative Refinery Association AND Cooperative Pipe Line Association

55th of a Series



PIPE LINE *Construction*

BIG news in pipe line projects for the month of September centered in two additional natural gas interstate lines, applications for which have been filed with the Federal Power Commission. A recent announcement by the commission revealed that during the first six months of 1948 3574 miles of line, increasing daily capacity by 878,500,000 cubic feet, were authorized. A good percentage of the lines authorized will be laid in the south and east portions of the U. S.

Another major transcontinental line was proposed when Gulfcoast Northern Gas Company, headquartered in Tulsa, filed application to construct a 1184-mile 26-inch line, 83 miles of lateral lines, and 12 compressor stations from an origin at or near the La Gloria-Seeligson gas fields in Brooks, Jim Wells, and Kleberg counties, Southwest Texas, to a terminus near compressor station No. 10 of Natural Gas Pipe Line Company of America, Henry County, Ill., in the Chicago area. Initial capacity of the line is to be 245 million cubic feet daily, with a foreseen increase to 350 million.

A second gas line, approximately 990 miles of 20-inch pipe, was proposed to FPC by the newly formed Piedmont Natural Gas Corporation, Spartanburg, N. C., with an origin in the Texas Gulf Coast gas areas and a terminus near Danville, Va., and a capacity of 215 million cubic feet of gas daily. There are to be 12 compressor stations on the line.

Western Gas Lines

In the western part of the country additional gas carriers were also under discussion as permission to increase by 100 million cubic feet the transmission of gas from West Texas fields to California was requested by El Paso Natural Gas Company and Southern California and Southern Counties Gas companies. Proposed construction would also increase gas flow to the El Paso area by 80 million cubic feet.

Another report from Texas-Western Oil Lines indicated that construction of a 24-inch oil pipe line from the Permian Basin area of West Texas to Los Angeles was believed feasible by the early part of 1949. The project, to be owned by the Texas producers and California refiners concerned, would reportedly be carry 150,000 barrels of crude per day.

Outside the U. S. Creole Petroleum Corporation's Ule-Amuay Bay crude line in Western Venezuela was being pushed to completion as rapidly as possible, with first shipment of oil through the line expected December 1, 1948. Early shipments will be confined to 200,000 barrels daily. Ultimate capacity will be 300,000-325,000 barrels per day. The line is being constructed by Williams Brothers Company of Tulsa, who also recently completed the crude outlet for Las Mercedes and Palacio fields in central Venezuela. The latter line is owned by S.A. Petrolera Las Mercedes, a subsidiary of The Texas Company and Caracas Petroleum Company. This line takes crude 158 miles to the marine terminal at Pamatagual on the Caribbean.

The governments of France and of Colombia were reported to be preparing to construct products lines. France had advanced plans for a line from the port of Le Havre to Paris, and Colombia was readying plans to extend its recently completed line from Barrancabermeja to Puerto Berrío to Puerto Salgar.

PIPE LINE CONSTRUCTION

Table includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
CRUDE OIL LINES					
Gulf Refining Co., Houston Pipe Line Division	Keystone field lines, Winkler County, West Texas	12	4 & 6	.....	Construction completed by J. J. Willis Construction Co., Odessa, Texas. Also completed 4½ miles of 4-inch from Clear Fork pay discovery to Keystone field.
Magnolia Pipe Line Co.	Near Yale, Okla.	30	2½ to 8	.....	Reclaim and recondition job completed by Western States Construction Co., Oklahoma City.
Mid-Continent Pipe Line Co.	Lindsay pool to Mavsville, Okla.	8½	4	4,800	Completed by A. C. Holder Construction Co., Tulsa.
	Loop from Cromwell station to Tiger Junction, Okla.	7	6	.....	Completed by A. C. Holder Construction Co.
Richmond Exploration Co.	Bojan, near Lake Maracaibo to tank farm, western Venezuela	22	18	.....	Williams Bros., Tulsa, starting project, which includes 4 miles of 16-inch and 8500 feet 18-inch, coated.
S. A. Petrolera las Mercedes (The Texas Co. and Caracas Pet. Co.	Guasimito station, Mercedes field, to Pamatagual terminal, Venezuela	158	16	.....	Project completed by Williams Bros., Tulsa, includes 6-inch connecting line to Palacio field.
Shell Pipe Line Corp. and The Texas Pipe Line Co. (Ozark Pipe Line System)	Cushing, Okla., to Wood River and Salem, Ill.	497	22	200,000	Contracts awarded for 6 spreads in September; construction starting October.
Stanolind Pipe Line Co.	Levelland station to Sundown station, Hockley County, West Texas	11½	10 & 6	.....	Construction completed on line replacing original 4-inch carrier.
	Wasson field terminal, on West Texas-Okla. line to Fullerton	43	12	.....	Construction awarded to O. R. Smith Contracting Co. Ft. Worth
	Fullerton field to Wheeler field, West Texas	37	10	.....	
	Wamsutta station, Sweetwater County, to Sinclair station 3, Carbon County, Wyo.	56	8	.....	Discharge line completed by C. L. Rogers Construction Co., Wichita Falls, Texas.
The Texas Pipe Line Co.	Humble pump station to Port Arthur, Upper Texas Coast	140	6, 8, 10	.....	Takeup and reconditioning awarded to Latex Construction Co., Houston. Pipe to be used in other projects.
	Wilson station, Archer Co., to Wichita Falls station on Basin Pipe Line System, North Texas	22	10	.....	Line will expedite N. Texas crude into Basin system. Earlier, a 196-mile 12-inch line planned from Corsicana Jct. to Wichita Falls. Contract awarded to Carl H. Dunn, Ft. Worth.
PRODUCTS LINES					
Absorption Plant, Inc. (McCarthy Interests)	Winnie to Port Neches, Upper Texas Coast	30	6	.....	Construction completed by Anderson Bros., Houston.
Colombian Government	Puerto Berrió to Puerto Salgar, Colombia	90	6	.....	Line to extend carrier recently completed bewteen Barrancabermeja and Pto. Berrío. Contract for planning and estimates awarded to Acosta and Madero Paris.

TABLE CONTINUED ON PAGE 200.

Stanolind Oil and Gas Company

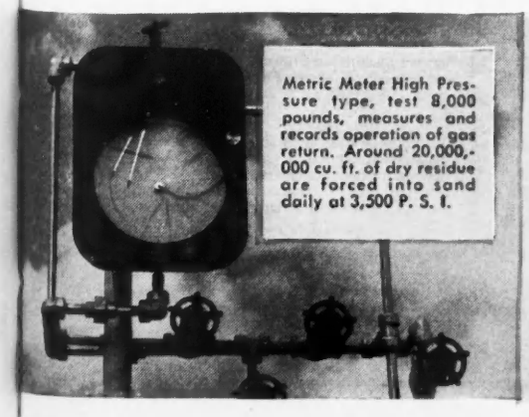
HAS INSTALLED HIGH PRESSURE METRIC ORIFICE METERS

Gas cycling and maintenance operations at the Hastings Plant call for pressures varying from slight vacuum for rich or wet gas to 3,500 P.S.I. when dry gas is pumped into the wells for gas lift and conservation purposes.

Efficient operation of this plant with a daily throughput of 35,000,000 cu. ft. calls for measuring instruments of highest accuracy and dependability.

Metric Orifice Meters are effectively serving the exacting requirements of this plant at Hastings. The California Company's Lake St. John and Cranfield Plants; Shell's Sheridan Plant; Humble's Katy, Tom O'Connor, Anahauc, Clear Lake Plants, and others are demonstrating the suitability of Metric Orifice Meters for high pressure applications up to 5,000 P.S.I.

WRITE FOR FULL INFORMATION


Metric Meter High Pressure type, test 8,000 pounds, measures and records operation of gas return. Around 20,000,000 cu. ft. of dry residue are forced into sand daily at 3,500 P. S. I.

AMERICAN METER COMPANY

INCORPORATED (ESTABLISHED 1836)

Albany • Atlanta • Baltimore • Birmingham • Boston • Chicago • Dallas
Denver • Erie • Houston • Joliet • Kansas City • Los Angeles • New York
Odessa • Orlando • Philadelphia • Pittsburgh • San Francisco • Tulsa

PIPE LINE CONSTRUCTION (Continued)

Table includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
Hunt Oil Co.	Plant near Lisbon to loading rack near Bernice, La.	21	....	.....	Wood Engineering and Construction Co., Tyler, Texas, laying line and building loading rack.
French Government	Le Havre to Paris, France	160	10	.....	Studies completed, right of way to begin as soon as state concession is granted. Completion planned for end of 1949.
Phillips Petroleum Co.	Near Dumas plant, Texas Panhandle	19½	4	.....	Vaughn & Taylor Construction Co., Wichita Falls, started job, but shut down for right of way.
NATURAL GAS LINES					
The Amarillo Oil Co.	Compressor and dehydration plant in Amarillo County, Texas Panhandle	.....	.....	.....	Plant will double flow of Panhandle gas to Amarillo area. Contract awarded to Chemical Plants Division of Blaw-Knox Co.
Arkansas-Louisiana Gas Co.	Gathering system in Village, Arkansas ,field	6	....	.....	Snelling Co., Shreveport, La., completing October 1.
	South of Texarkana, Texas	7½	10	.....	Takeup, recondition and relay job under way by Wood Engineering and Construction Co., Tyler, Texas.
Azienda Metanodotti Padani	Contarina to Porta Marghera, near Venice, Italy	....	6	21 mln	Under construction.
Cities Service Gas Co.	Ottawa to Kansas City, Kans.	52	26	.....	Completed by Midwestern Constructors, Tulsa. Section is northern terminus of 405-mile line from Ulysses, in Hugoton field, Kans., with 172-mile connecting section from Hutchinson to Ottawa to be laid in 1949.
	Kansas City to Independence, Mo.	6	16	.....	
	Mound Valley to Columbus, Kans.	44½	20	.....	Completed by company crew. Replaces 16-inch line.
The Gulf Coast Northern Gas Co.	La Gloria-Seeligson, Southwest Texas, to Chicago area, Ill.	1,184	26	245 mln	Application filed with FPC, includes 12 compressor stations. Capacity ultimately to be expanded to 350 mln feet daily. Construction to begin within 6 months after FPC approval.
	Lateral to Feasel gas field, Arkansas	57	18		
	Lateral to Logansport gas field, Arkansas	26	10		
Jefferson Pine Line Co. (McCarthy Interests)	Winnie to Orange, Upper Texas Coast	45	12	.....	Completed end of September by Anderson Bros., Houston.
Manufacturers Gas & Power Co.	Callicoon area, N.Y.	30	12	.....	Britton Contracting Co., Ft. Worth, has work under way.
Natural Gas Pipe Line Co. of America	Loop from point near Geneseo to La Salle, Ill.	53	24	.....	H. C. Price Co., Bartlesville, Okla., completing in mid-October.
	Loop near Oskaloosa, Iowa	13⅜	26	.....	Midwestern Constructors, Tulsa, completing mid-October.
	Loop near Geneseo, Ill.	13⅜	26	.....	
New York State Natural Gas Corp.	Sharon field, Potter Co., to compressor station, Pa. border	8	16	.....	Construction completing mid-October.
Ohio Fuel Gas Co.	Treat station, Licking County, to Auburn, Crawford County, Ohio	52	20	.....	Mahoney Contracting Co., Mt. Pleasant, Mich., constructing line. which replaces 75 miles of 10-12 and 16-inch pipe in area.
	Lebanon station on Big Inch, Warren County, to Centerville station, Montgomery County, Ohio	8	18	.....	Anderson bros., Houston, completing end of September.
Oklahoma Natural Gas Co.	Loop near Chikasha, Okla.	35	12	.....	Trojan Construction Co., Oklahoma City, has work under way.
	Loop near Maysville, Okla.	35	12	.....	Trojan Construction started September.
	Loop near Muskogee, Okla.	10	18	.....	Trojan Construction to start in November.
Panhandle Eastern Pipe Line Co.	Loop near Centralia, Mo.	15	26	.....	Midwestern Constructors, Tulsa, awarded contract.
	Pleasant Hill, Ill.	10⅝	26	.....	Midwestern Constructors awarded contract.
	Glenarm, Ill.	17⅛	26	.....	Midwestern Constructors starting right of way work.
Piedmont Natural Gas Corp.	Upper Texas Coast to Danville, Va.	990	20	.....	Application filed with FPC; construction proposed within 90 days of approval of certificate.
Roumanian Government	Târgul Mures Gas fields to Bucharest	35	..	.....	Under construction. Line said to step up supply of gas to 39 mln cubic feet a day.
Southern California Gas Co.	Point near Desert Center to Point on All-American Canal, Calif.	28	8	.....	Alex Robertson Co., Clearwater, Calif., constructing.
	All-American Canal to Calexico, Calif.	48	4–16	.....	Joint project by Utility Construction Co., South Gate and Signal Pipe Line Co., Long Beach, Calif.
	Lateral from El Centro to Holtville	9	4	.....	Laterals in planning stage, no contracts awarded.
	Lateral from point south of Rockwood to Westmoreland, Calif.	6	....	.....	
	From terminus of Santa Fe Springs-Pasadena line (under construction) to Altadena, over to tie in with Flintridge-La Canada system	8	12 & 20	.....	Pacific Pipe Line & Engineers, Los Angeles, to complete in November.
Southern Union Gas Co.	Near Albuquerque, N.M.	13	10	.....	H. B. Zackry Co., Odessa, Texas, has work under way.
Tennessee Gas Transmission Co.	Looping in Louisiana	57	26	.....	Completed by company crews late August.
	Looping in Texas	15	6	.....	Completed September by Sheppard-Geiger Construction Co., Corpus Christi, Texas.
	Looping in Mississippi	45	26	.....	Completed September by H. C. Price Co., Bartlesville, Okla.
	Looping in Tennessee	100	26	.....	Completed September by Morrison Bros. Construction Co., Odessa, Texas.
The Texas Co., Gas Division	Golden Meadows to Bay St. Denis, La Fitte area La.	20	8	.....	Associated Contractors & Engineers, Houston, constructing.
Texas Eastern Transmission Corp.	Hastings field to Baytown, Upper Texas Coast	18	8	.....	Contract awarded to Brown & Root, Houston.
	Waskom field to Jefferson, Upper Texas Coast	28	8 & 10	.....	Contracts for all following spreads not awarded.
	Bryceland, Hico-Knowles fields, La., to TETCO 20 and 14 inch lines	8½	6, 10, 12	.....	
Texas Gas Transmission Corp.	Lula, Miss. to Memphis, Tennessee	63	26	67 mln	Gas storage system tying into City's distribution system being constructed by N. A. Saigh Co., San Antonio, and Horrigan Construction Co., Houston.
	Compressor station at inlet side of Lisbon pipelines, Claiborne Parish, La.	....	....	.....	Authorized by FPC, plus one 1200-HP compressor unit in each of 3 stations in Arkansas and Mississippi.
Trans-Continental Pipe Line Co.	Mercedes, Southwest Texas, to New York City	1,800	26	.....	Construction to start May, 1949. Engineering by Fish Engineering Co., Houston. Preliminary work and station sites to be done this fall.
United Gas Pipe Line Co.	Carthage area, near Beckville, East Texas	6	10	.....	Wood Engineering & Construction Co., Tyler, Texas, constructing. Includes 2½ miles of 8-inch.
Warren Petroleum Corp.	Gladewater to East Texas field	9	6	.....	Titsworth and Partain, Kilgore, Texas. Constructing.

How to do it!

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Devise Efficient Locking System for Valve Box Covers

In order to provide a valve box cover that would be tamper-proof, yet readily accessible and easily handled by field men or an inspector, one company devised two simple but very effective types of locking systems. As can be seen in the installations in the two accompanying photographs, they are similar in that each has a pair of close-fitting steel covers that extend across the top of the rectangular box, and each box is provided with a series of regularly-spaced rectangular loops embedded in the surface of the concrete.

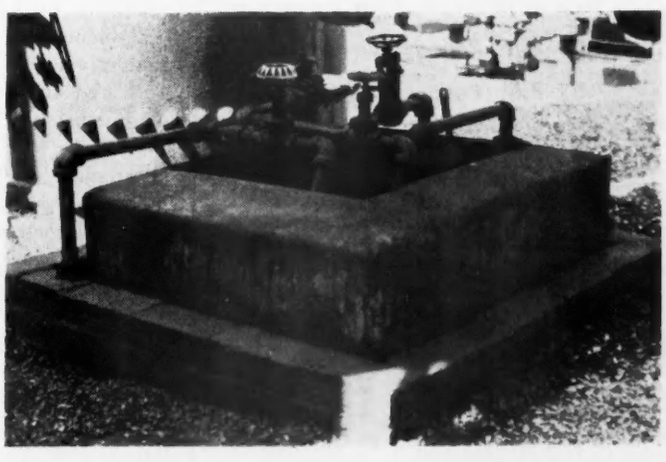
In one installation (top photo) the covers are held in place by short pieces of sucker rod material that are welded to the corners of the plates, these rods being sufficiently long to project under the steel loops, yet provide sufficient clearance that the covers can be maneuvered out horizontally if and when they are to be removed. A length of heavy T-bar is placed across the two cover sections and held in place by slipping the distant end under one of the steel loops and running the front end over a steel bar embedded in the side of the concrete box. A single padlock is then run through a hole in the end of the embedded bar, thus securely locking the entire box.

In the other installation (bottom photo) the assembly is similar except that instead of having bars welded to the plate corners, small rectangular steel tabs are welded to the under side of the steel loops. The cover plates are slid under these tabs and held in place by the locking bar which, as in the first installation, is locked with a single padlock.

A minimum of material and fabrication work is required for either type of cover. To facilitate lifting or sliding the cover plates, a small lifting handle is provided with each box.

HOW TO—Make Splash-Proof Shield to Place over Sump Opening

Sludge and liquids withdrawn from scrubbers at a high-pressure gas transmission compressor station can be prevented from splashing over adjacent equipment by using a sheet iron shield placed over the sump opening. Light weight sheet steel, similar to tank decks, is cut in strips approximately 30 inches long and 18 inches wide, four similar strips being used to make the complete shield. The top six inches of each strip is bent sharply to approximately ten degrees from the horizontal and mitred so that a rectangular box can be made by welding the four seams.



Edges are smoothed to remove burrs and prevent catching of waste or wiping rags. The shield is placed over the sump opening and connections made up on the drain lines to direct the liquid as nearly to the center as practicable. Splashing is deflected by the sides and overhang of the shield so that a minimum amount of liquid escapes to spoil a painted surface.

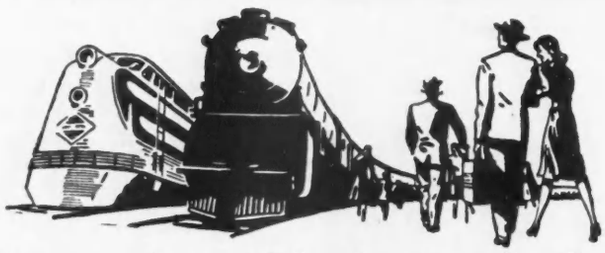
MAKE YOUR TRAVEL PLANS

NOW!

28TH ANNUAL MEETING
AMERICAN
PETROLEUM
INSTITUTE

NOV. 8 THRU 11

CHICAGO



Remember this fast schedule

WHEN PLANNING YOUR TRIP

from the Southwest

LV. HOUSTON	7:45 A.M.	*Sunset Limited*
LV. BEAUMONT	9:26 A.M.	*Sunset Limited*
LV. LAKE CHARLES	10:46 A.M.	*Sunset Limited*
AR. NEW ORLEANS	4:15 P.M.	*Sunset Limited*
LV. NEW ORLEANS	5:00 P.M.	*Panama Limited*
AR. JACKSON	7:52 P.M.	*Panama Limited*
AR. MEMPHIS	11:35 P.M	*Panama Limited*
AR. CHICAGO	9:30 A.M.	*Panama Limited*

Similar fast service returning
For fares, reservations and other travel information, call SP Agent

Southern Pacific

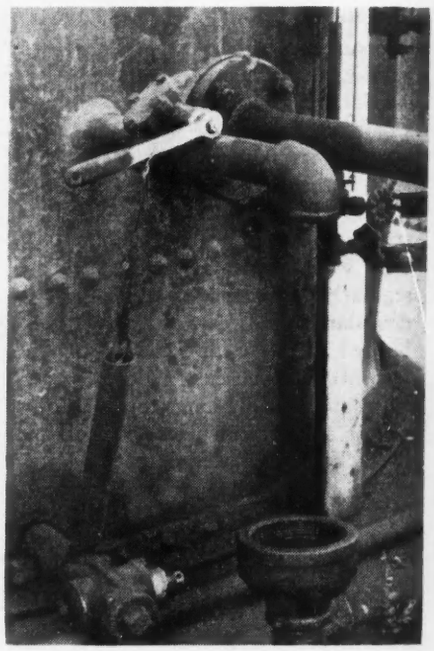
J. F. SULLIVAN, Passenger Traffic Manager
Southern Pacific Bldg., Houston, Texas

HOW TO—

Assure Positive Valve Shutoff on Oil Tanks

A compressor station requiring quantities of lubricating oil has vertical steel tanks for current oil storage. These tanks are equipped with pipe lines which lead to a central reservoir of a continuous circulation system. In addition to the circulation of lubricant in the crank-cases and lubricators, oil is frequently required for auxiliary equipment and is withdrawn from connections on the tank through quick open and shut valves.

To provide a means of positive closing of these valves, heavy tension



springs are used. One end of the spring is attached to a small hole drilled in the valved handle and the other end anchored to a water drain line immediately below the valve handle. By adjusting the tension of the spring through shortening or lengthening the connections, the valve handle will snap down, when released, to tightly close the valve without conscious effort on the part of the operator. A few drops of oil, now and then, or continuous dripping from the service line because an operator neglected to press the valve tightly shut, can be prevented by an investment of a few cents for a common helical spring.

THOMPSON-HAYWARD FORMALDEHYDE *Reduces* CORROSION

- Save on Pulling Costs
- Save on New Steel
- Save on Shutdown Time
- Low Cost
- Dependable
- Field Tested

Protect expensive and hard-to-get steel parts from hydrogen sulphide corrosion and corrosive mine and well waters, with Thompson-Hayward Formaldehyde.

Warehouse Stocks Available For Prompt Shipment

THOMPSON-HAYWARD CHEMICAL CO.

DALLAS · HOUSTON · DENVER
WICHITA · TULSA · SAN ANTONIO
NEW ORLEANS

You'll find 'em where the GOING is TOUGH!

HOBBS POLE TRAILERS

Built in the center of the great Texas oil fields, HOBBS Pole Trailers are engineered to get the job done economically where the going is toughest. And HOBBS Pole Trailers can take punishment too. Ask anyone who uses Hobbs equipment.

Three Models to Get the Job Done!

Engineered for use behind trucks with oil field bodies; with trucks not equipped with platform bodies; one model is 4-wheel wagon usable many ways.

ASK FOR SPECIFICATIONS

HOBBS MANUFACTURING COMPANY

HOUSTON, TEXAS · FORT WORTH, TEXAS

Please Mention World Oil

EXTRA EASY *Threading* OF SMALL PIPE

RIDGID 00R Ratchet Threaders give quick, clean threads on 1/8" to 2" pipe

● No bothersome get-ready with these handy little RIDGID Threaders. Just snap in size die head you need and go to work. Even on close-to-wall threads there's no fuss or trouble—no extra dies required. These RIDGID Threaders make it easy to get clean, quick threads on all kinds of small pipe. Sturdy steel and malleable construction—long life heat-treated tool-steel dies. No. 00R 1/8" to 1" pipe; No. 111R, 1/8" to 1¼"; No. 12R 1/8" to 2". Buy them at your Supply House.

Free handy carrier for any group of sizes.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY · ELYRIA, OHIO

Pipeline Contractors know they can depend on First of Tulsa for adequate financing. Many a pipeline has been finished quicker because of First of Tulsa's complete knowledge of every phase of the oil industry.

●

When you need additional working funds to successfully complete a job look to

1st of Tulsa

THE FIRST NATIONAL BANK AND TRUST COMPANY OF TULSA

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

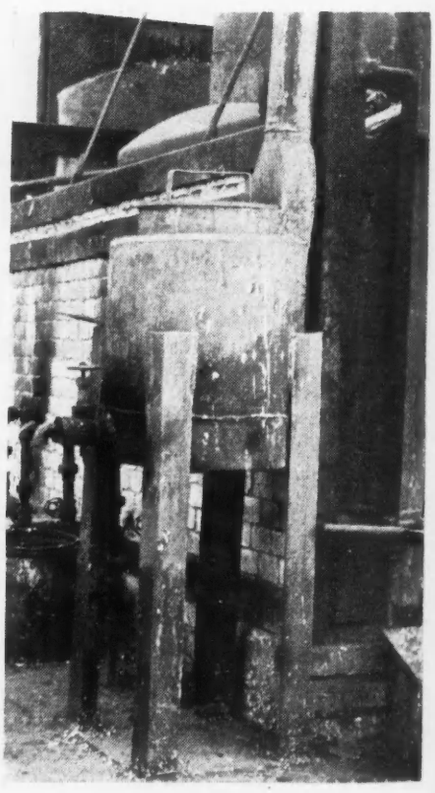
PIPE LINE HINTS

HOW TO—

Make Babbitt Furnace

When large bearings are to be poured for rebabbitting journals on engines or pumps, an adequate supply of molten metal is necessary. One company has built a furnace to melt bearing metal in quantities adequate for several journals at one time. The furnace has a melting pot made of 12-inch pipe inserted in a jacket of 16-inch pipe which is open at the bottom to accommodate gas burners and also to provide draft. Double burners beneath the babbitt pot produce enough heat to quickly melt the metal and keep it hot enough to pour.

The molten metal is drawn by a gate valve on the side of the pot into a pouring ladle. The body and fittings of the withdrawal gate are covered with a split pipe jacket into which heat is drawn to keep the metal fully molten in the body of the valve and in the pipe nipples to which it is connected. The valve is all iron and opens and closes easily as long as the babbitt is molten but cannot be opened when cold. The furnace is supported at a convenient height above the ground by four angle iron legs welded to the jacket. A flat metal lid closes the melting pot, and draft is obtained by a stack attached to one side of the top head of the melting pot jacket.



The Problems of Off-the-road Hauling

● Off-the-road oilfield hauling requires the transportation of huge rigs and heavy loads through tough running conditions of mud, sand, soft dirt, slippery surfaces and steep grades. You cannot do it with trucks that bog down and stall in difficult terrain.

The Solution—WALTER TRACTOR TRUCKS

FOR difficult off-the-road operations, you require trucks having unfailing power and traction under all conditions. That means Walter Tractor Trucks, with the super-traction of Walter 4-Point Positive Drive. In this exclusive drive system you get 100% positive traction in all four driving wheels. There are never slipping, spinning wheels to stall your loads.

Other features include: Walter Suspended Double Reduction Drive which provides greater reserve strength, less unsprung weight, higher ground clearance; Walter Tractor Type Transmission, extremely rugged in construction, which furnishes proper gear ratios for every need; balanced design with short wheelbase, short turning and correct weight distribution; powerful air brakes; hydraulic power steering; fully rated motors, gasoline, diesel or butane, 150 to 300 hp.

Write for literature which gives detailed information on all the features of Walter Tractor Trucks.

WALTER MOTOR TRUCK CO. 1001-19 Irving Ave. Ridgewood 27, Queens, L. I., N. Y.

WALTER TRACTOR TRUCKS

Fair Exchange is Good Business in *Mid-America*

In Mid-America's pioneer days, men exchanged their goods and their labor for the products of the forge. Today, as Sheffield supplies Mid-America with steel from Mid-American mills, the principle of "Fair exchange" is relatively unchanged.

For example. When you exchange dollars for any of the many and varied Sheffied steel products, the exchange is just beginning.

Sheffield spends those dollars with you—directly in the purchase of materials such as coal, coke, limestone, petroleum products, agricultural products, electric power, fire brick and many others. Or indirectly in the wages paid to Sheffield employees. Those wages ultimately help pay you for your daily work, for they are spent for the many things needed in modern living

Because more of every dollar spent for Sheffield steel products stays at home—in Mid-America—more and more manufacturers east of the Rockies and west of the Mississippi are specifying Sheffield Steel and putting "fair exchange" to work for Mid-American prosperity

SHEFFIELD STEEL CORPORATION
HOUSTON KANSAS CITY TULSA

SALES OFFICES: Chicago, Ill.; St. Louis, Mo.; Des Moines, Ia.; Omaha, Nebr.; Wichita, Kans.; Denver, Colo., Oklahoma City, Okla.; Dallas, Tex.; San Antonio, Tex.; Lubbock, Tex.; New Orleans, La.; Shreveport, La.

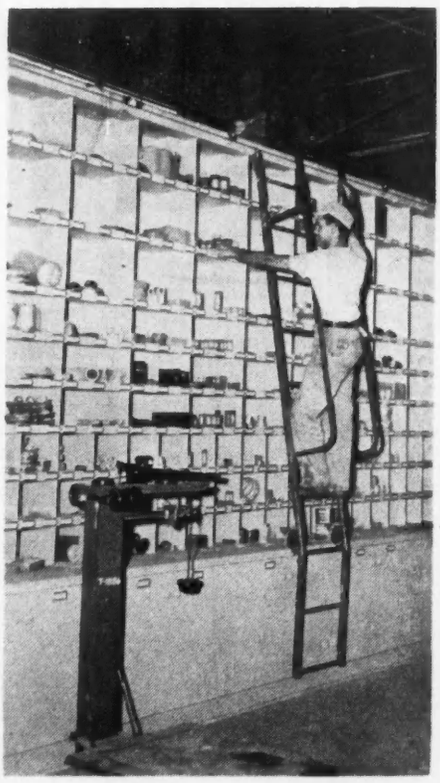
EAST OF THE ROCKIES...WEST OF THE MISSISSIPPI
SHEFFIELD STEEL
Carbon and Alloy Steel, Ingots, Blooms, Billets, Plates, Sheets, Merchant Bars, Steel Joists, Structural Shapes, Road Guard, Reinforcing Bars
Welded Wire Mesh, Wire Products, Wire Rods, Fence, Spring Wire, Nails, Rivets, Grinding Media, Forgings, Track Spikes, Bolt and Nut Products

PIPE LINE HINTS

HOW TO—

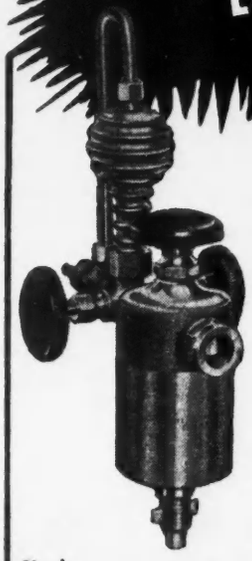
Make Movable Ladder To Reach Parts Bins

In the compressor station of a trunk gas line, many parts must be stocked for quick repair, as the station most often is far from ordinary sources of supply. On the TGT, small parts are stored in bins or shelves, depending on their nature, with the heavier units at or near floor level. In the upper sections of the shelving are ranged the lighter units, arranged not in order of the parts numbering system, but displayed so that the quantity and style can be visually determined.



To give quick access to these upper shelves a movable ladder, composed of welded pipe, is used. The upper end of the ladder is mounted on two barn-door hangers, which run in standard barn-door rail sections. The base is supported by two rubber tired truck wheels, which run along the outer edge of the top of the bin section. Working from the ladder, the parts department man can shift from shelf to shelf without need for much climbing of the ladder, and the parts requisition thus can be filled in short order.

STEAM CYLINDER LUBRICATORS



Single Connection

SWIFT LUBRICATORS

For years have been widely used by the oil producing and refining industry for cylinder lubrication on steam-driven slush pumps, boiler feed pumps, drilling engines and other similar equipment.

Simple, dependable and inexpensive, Swift Lubricators are especially suitable for use in cold, exposed weather service. The famous Swift bullseye sight-feed tells at a glance the rate of oil feed. This style of sight-feed eliminates leakage, repacking and glass breakage common with the tubular glass types.

Available in ½ pint, 1 pint and 1 quart sizes in both single and double-connection styles. Your supply house has them or can secure them for you.

SWIFT LUBRICATOR CO., INC.
27 Home Street, Elmira, N. Y.

Perfect
PIPE THREADS IN RECORD TIME

RIDGID No. 65R is ready to thread 1" to 2" pipe in a mere 10 seconds!

● Here's a rugged pipe threader that's really fast and easy to work. Sets to size in 10 seconds to thread 1," 1¼," 1½" or 2" pipe. Workholder sets instantly — only one screw to tighten, no bushings. RIDGID No. 65R is self-contained — no dies to haul around or lose; one set of tool-steel chaser dies gives you accurate threads on any kind of pipe or conduit . . . with surprisingly little effort. Every No. 65R is factory-tested. Buy from your Supply House.

Stands on its own feet ready for instant use.

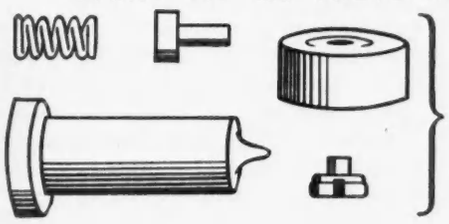
RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO

Best Buy Today
Below Your Costs
Government Surplus—New

"71" DIESEL GM PARTS

Complete Assembly or Individual Parts

SPRAY TIP and VALVE ASSEMBLY



No. 5227325
Spray Tip and Valve Assembly consists of
1 Stop Check
1 Valve Spring
1 Spray Tip—7 hole
1 Valve and Seat
Sold in part or as complete assembly

These and many more

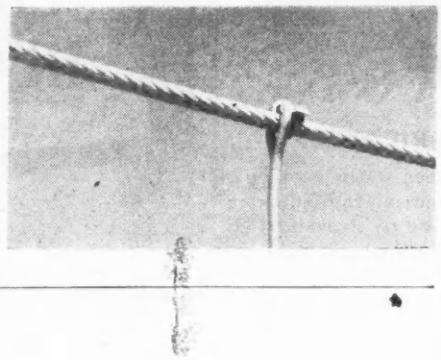
NUMBER	DESCRIPTION
5226888	Injector Filter Element
8502957	Oil Cooler Element 12 Stack
5227325	Spray Tip and Valve Assembly
5227231	No. 80 Injector and Case
5157393	Blower Assembly—Left
5157396	Blower Assembly—Right

Write for complete parts list and low net prices.

SURPLUS AUTOMOTIVE COMPANY "DEISEL PARTS SPECIALISTS"
1329 S. MICHIGAN AVE. CHICAGO 5, ILLINOIS

HOW TO—Make Clip to Improve Grip for Pipe Line Support on Cable

A modified cable clip that greatly simplifies the work of installing a cable-suspended pipe line over a gully or river crossing is illustrated in the accompanying photograph. The clip is made sufficiently wide to take in the two cables employed in this particular installation. To the flat bar spanning the U-bolt is welded a half-circle section of ¼-inch steel which has an internal diameter sufficiently great to confine, yet not actually clamp down upon the loop formed in the ¾-inch round bar on which the pipe line is suspended. With such a device, the vertical rod is free to move slightly with the swaying motion of the entire suspension, yet without materially wearing the clips which hold the rods in their proper positions along the length of the suspension. During the installation of a suspension, the simple means of holding the rods in place contributes much to the speed of rigging-up and adjusting the several clips.



A Leader in

OIL FINANCING

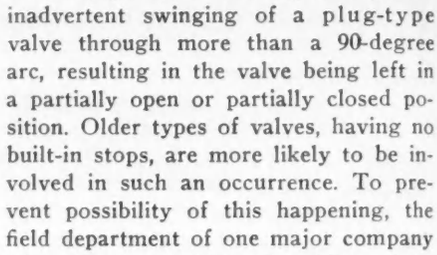
...because oil men like the way the Republic does business. With a thorough working knowledge of the oil industry this bank is particularly qualified to handle the financing of oil production.

REPUBLIC
NATIONAL BANK of DALLAS
CAPITAL & SURPLUS $25,000,000 LARGEST IN THE SOUTH

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

HOW TO—Use Sucker Rod Stubs To Restrict Valve Travel

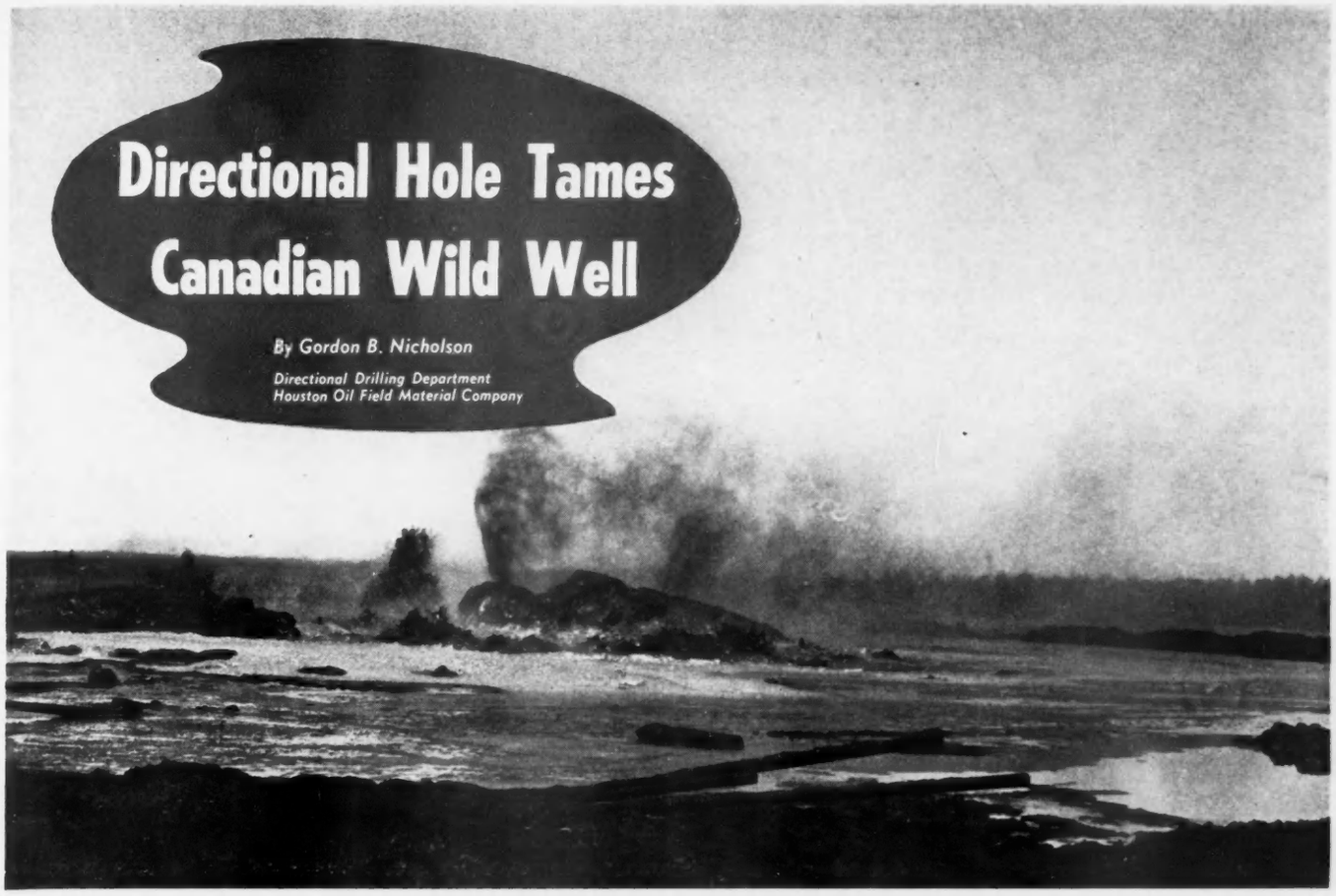
It is not an infrequent occurrence to have complications develop through the inadvertent swinging of a plug-type valve through more than a 90-degree arc, resulting in the valve being left in a partially open or partially closed position. Older types of valves, having no built-in stops, are more likely to be involved in such an occurrence. To prevent possibility of this happening, the field department of one major company adopted the practice of welding short stubs of sucker rod material to the upper surface of the pipe line as illustrated in the photograph. These vertical projections restrict the travel of the valve handle and serve to emphasize to field men the importance of having the valves turned through exactly 90 degrees, neither over nor under. Such a practice eliminates the danger of having pumps blow safety valves or stuffing boxes and having motors stall or burn up.



Directional Hole Tames Canadian Wild Well

By Gordon B. Nicholson

Directional Drilling Department
Houston Oil Field Material Company



In blowing wild for four months, Atlantic 3 spouted oil all over the surrounding wheatlands. Oil flowed to a lower section of the lease, where a large earthen reservoir held it until it would be removed.

THE wildest well in Canadian history was finally killed early in September by means of a directional relief well. While Atlantic No. 3 blew gas and pipe line oil for four months over a wide area in the Leduc field, Alberta Province, the directional hole painstakingly bored its course through the hard rock formation to intersect the highly charged D-3 zone of the Devonian at a point about five feet from the estimated bottom of the wild well. With the heart of the blowout thus penetrated, high pressure pumps were utilized to load the formation with water and curb the pressure responsible for its wild flow.

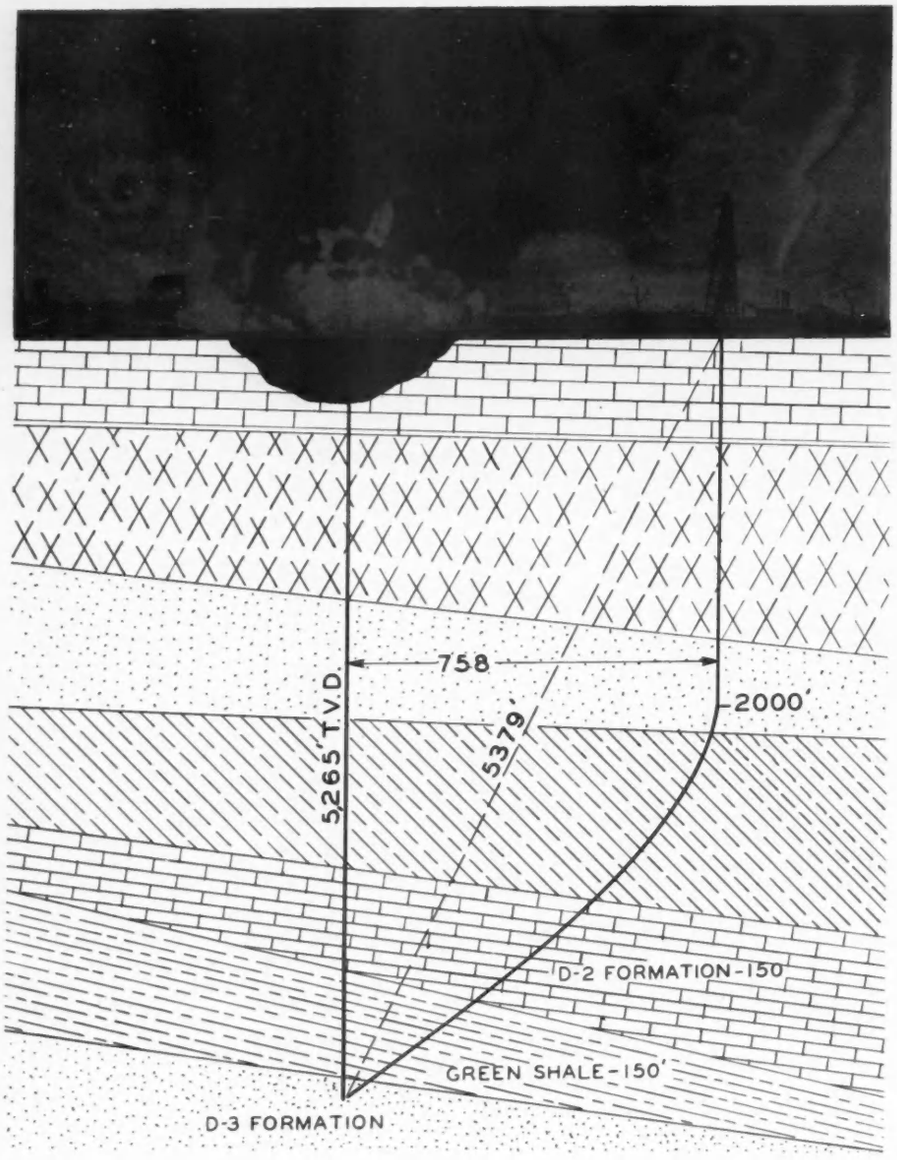
Drama and suspense marked the last hours of the life of Atlantic 3. Fire, a constant threat enveloping all activities around the wild well, became a stark reality on the very day that the bit of the West Relief well penetrated the D-3 formation. Bursting into flames late in the afternoon of September 6, the blaze quickly covered the entire 40-acre area which had become saturated with oil previously. By coincidence, drilling on West Relief reached its climax on this same eventful day. Thus, with water lines and heavy duty pumps already positioned at the wellhead of the relief well, within a few hours clear water under pressure was being injected into the D-3, with almost immediate results apparent in the behavior of Atlantic 3.

For four months Atlantic 3 had enjoyed an uninterrupted life of uncontrolled fury during which several million barrels of oil belched from the prolific Leduc reservoir. All direct methods of control failed, and two rigs were hurriedly moved into position for directionally drilling two wells into the troublesome area beneath Atlantic 3 at the core of the trouble to permit a systematic flooding of the formation at the point of the blowout, and to load the bore of Atlantic 3 with a heavy hydrostatic head of clear water, followed by mud and cement if necessary. Atlantic West Relief reached casing depth late in August; then final preparations were made to drill into the limestone D-3 section. It was during this latter stage that the long-feared "spark" set Atlantic 3 afire.

ATLANTIC NO. 3, the wild well which blew out of control in Leduc field early this spring, has finally been subdued by a directional relief well. The relief well was completed on September 6—the very day on which the wild well caught fire—and by September 9, it had succeeded in bringing the wild well under control for the first time in many months.

Importance placed on control of the wild well from both the conservation and economic standpoints is evidenced by the decision to drill two relief wells, this operation probably being the first time in the history of directional drilling that dual relief operations were attempted. Purpose of the second well was to add a safety factor in tapping the formation as rapidly as possible in the event that either relief well suffered from mechanical or other troubles which might delay drilling.

History of the Leduc field, although of short duration, had been spectacular and filled with promise of bringing to Western Canada the biggest oil field since the discovery of Turner Valley, perhaps even exceeding this field in scope. Development of Leduc, located approximately sixteen miles southwest of Edmonton, Alberta, had been rapid but orderly during the first year following its discovery in the early part of 1947, although unearthing the big pool caused considerable excitement in the



Artist's conception of Atlantic 3 after catching fire, with schematic diagram showing projected path of directional well drilled from the West. Water injected under pressure through West Relief soon established channels between the two wells to permit loading the wild well with water. Weight of the hydrostatic head of fluid soon nullified the pressure and killed the well. (Diagram not according to scale.)

Edmonton vicinity where large-scale oil production had been unknown previously. Imperial Oil, Ltd., drilled the discovery well and took the initiative in developing the big field. Wells were completed in two producing zones of the Devonian, known locally as the D-2 and D-3, with the latter being the deepest horizon, found at depths from 5200 to 5300 feet.

Atlantic Oil, Ltd's., No. 3 blew out last March, but after a few hours was brought partially under control. The well caused intermittent trouble, making frequent attempts to blow out and charging the upper formations with oil and gas which staged minor blowouts through surface crevices and geophysical shot holes. Finally, on May 8, Atlantic 3 went out of control completely, with oil and gas blowing through and around the drill pipe and from numerous seepage areas scattered over a half mile radius from the rig. Production varied between 7000 and 14,000 barrels of pipe line oil daily along with 30 to 50 million cubic feet of gas, the flow covering a large area and inundating the surrounding wheat lands.

With upper sands charged with oil and gas under pressure, numerous geysers appeared, some as much as a half-mile from Atlantic 3. These spouts of oil generally came from fissures or crevices connected directly or indirectly with underground charged formations, or from geophysical shot holes which offered unrestricted channels for flow to the surface. The minor geysers usually cratered and settled down to a steady bubbling and surging of oil and gas, overflowing and draining toward the lower end of the lease.

Major cratering prior to the fire occurred near the rig, centering some 50 yards in a northerly direction from the casinghead. During the first few days following the blowout, constant concern was felt as the crater slowly moved toward the rig, continually increasing in size. With the edge of the crater finally approaching within 50 feet of the rig, further cratering ceased, and although the hazard existed until the last few hours of the blowout, the central crater held this position, with the rig perched precariously on its edge.

With acres of land saturated with overflow oil, and with shifting winds blowing the inflammable spray in virtually all directions, a menacing fire hazard developed and remained throughout the life of Leduc's wild well, requiring constant vigilance on the part of all parties to prevent the inestimable devastation resulting from a fire. Happily, the safety measures employed by operators in the field in conjunction with the Petroleum and Natural Gas Conservation Board of Alberta were successful until the end was near, and virtually all oil produced during the period was recoverable.

One of the first immediate problems following the blowout resulted from the inadequate oil transportation facilities in the field. Oil from Atlantic 3 roughly doubled the total field production, and in order to transport excess oil from the hastily constructed earthen reservoirs, all other producing wells in the field were shut in. Thousands of barrels of surplus oil were injected into the ground through Atlantic 1 and 2 for temporary storage. Scores of extra oil transports were directed to Leduc to move oil, and the limited pipe line facilities of the field were taxed to full capacity.

Railroad tank cars were directed to Nishku, located a few miles east of the field on the railroad and site of a small oil loading terminal. During the peak period, a tank car was loaded every 20 minutes at the Nisku terminal. After a period of several weeks, sufficient facilities were available to remove all oil from Atlantic 3, and the remaining wells in the field were again permitted to produce.

When Atlantic 3 first blew out of control, and with the consent of Atlantic Oil Ltd., the Conservation Board entered into plans for killing the wild well, ultimately calling on Imperial Oil Ltd., the largest operator in the field, for direct aid in its control. V. J. Maroney, general superintendent for Imperial, was borrowed for technical advice, with

Charles Visser of Imperial collaborating in the active supervision of field operations. During the early stages of formulating plans for control of the well, G. E. Cannon and C. W. DeLancey of Humble Oil & Refining Company of Houston visited Leduc to make recommendations based on their experience in high pressure fields on the Texas and Louisiana Gulf Coast.

Numerous attempts were made to kill the flow from the wild well by various direct methods. Wild well experts were brought into Canada from as far away as Texas to apply control methods which had proven successful in scores of wild wells the world over. These methods failed to stem the flow of Atlantic 3.

Explosives were lowered into the hole and detonated without effect. On one occasion, 10,000 sacks of cement were pumped into the wild well and disappeared without a trace, also without altering the well behavior. Tons of sealing materials such as mud, feathers, wood fiber, and sawdust were pumped into the hole.

During a period of several weeks, some 700,000 barrels of fresh water were pumped from the Saskatchewan River and injected into the D-3 horizon through nearby Imperial 48, at a rate exceeding the rate of withdrawal from Atlantic 3. Although frequent tests were made on the flow from the wild well, no trace of water was ever found, and injection was stopped as the water flooding had only increased the flow from Atlantic 3.

Almost from the start, the overall plan for control of Atlantic 3 included drilling two directional relief wells, having surface locations at a comparatively safe distance from the wild well, and projected to drill controlled deflected holes into the D-3 formation to bottom underneath Atlantic 3. Purpose of the deflected holes was to permit a close-range flooding of the formation and the bore of the wild well. Two companies specializing in directional drilling were selected to drill two wells, known as West Relief and South Relief respectively.

Two steam rigs of General Petroleums, Lt., were moved to the sites of the relief wells, with the boilers being set far back to isolate their fires as completely as possible from the wild well. South Relief spudded first and drilled vertically to 2800 feet, where the first deflecting tool was set by Charles Smith, engineer for Eastman Oil Well Surveying Company. Objective of South Relief was 707 feet, direction north 7 degrees 47 minutes east, which position marked the surface location of Atlantic 3.

Looking east, the relative positions of West Relief and Leduc's wild well are clearly defined. Located 758 feet apart, an average angle of 16 degrees from vertical was needed for the relief well to reach its objective.

Several days later, Atlantic West Relief was spudded and drilled to 2000 feet where the first whipstock was set. Directional drilling engineers L. H. Kern and Joe Allen of Houston Oil Field Material Company, Inc., supervised the directional phase of West Relief, with their objective located 758 feet distant, 5250 feet below the surface, the direction being S. 84 degrees 14 minutes east. Starting the deflection at 2000 feet, the deviated hole was projected to drill with an average angle of approximately 16 degrees from vertical.

Both directional holes shared good and bad fortune. Mechanical difficulties delayed both operations at times, while capricious winds, when blowing from northerly or easterly directions, often necessitated shutting down the boilers of one or the other rigs as a fire prevention measure. So important was wind direction that windsocks were placed around in airport fashion to warn drilling personnel of the first tendency of a wind shift into an unfavorable direction.

Throughout the drilling of both directional holes, caving and sloughing of the formation presented a constant danger, forcing continual observance of the drilling mud, with unusually high viscosities needed to maintain a clean hole. Invariably, prior to running a deflecting tool, several hours were devoted to hole and mud conditioning, to assure free runs of the tools to bottom.

By coincidence, the first deflecting tools were set in the two directional holes almost simultaneously during the week end of June 6, with South Relief 2800 feet deep at the time and West Relief 2000 feet deep. Both wells received satisfactory "kicks" from the first whipstocks, with angle and direction developing as desired.

South Relief reached its objective with the setting of only seven deflecting tools, maintaining good angle and direction, but suffered a severe setback when attempting to run casing. Due to formational difficulties, the seven-inch casing refused to go to bottom in the nine-inch hole and tried to stick, but was finally freed and removed from the hole. When going back into the hole with a rock bit pilot reamer, the deflected hole was accidentally sidetracked at approximately 3700 feet, and despite efforts of the drilling personnel, the original hole could not be located. Numerous additional deflecting tools were set in the hole to divert its part in an attempt to locate the old hole, but without success. From this stage, South Relief suffered many mishaps including stuck drill pipe, lost tools, and fishing operations. From

the point of the sidetracking at 3700 feet, it was necessary to drill a completely new hole on South Relief.

Almost from the start, West Relief showed a tendency to lose angle while drilling, despite the fact that the deviation easily developed to the required 16 degrees. While drilling ahead, however, the hole made constant attempts to straighten, and a number of additional whipstocks were run periodically to re-establish the angle to the degree required.

With the setting of 13 tools in West Relief, casing depth was reached at a distance believed to be only eight feet from the bottom of Atlantic 3. As a precaution, however, a check survey in open hole was run, to confirm the running survey made inside a non-magnetic drill collar during the course of drilling the directional well. The comparative surveys showed a discrepancy, and a second open-hole single-shot survey was made, followed by an open-hole multiple-shot survey. All the open-hole surveys agreed in results, but showed an error in the original calculations on the position of the bottom of West Relief. This mistake, it was determined, resulted in the cumulative error occurring at high angles when surveying inside a non-magnetic drill collar while deviating in an easterly direction, or in a direction contrary to the direction of the earth's magnetic field. With the cause of the error determined, adequate compensations were made to avert its recurrence.

With the recalculated position of West Relief showing its bottom about 40 feet distant from its objective, it was decided as a surety measure to plug back for redrilling closer to the objective, although it was believed that the bottom was already sufficiently close to assure success of the operation. A plug was set at 4700 feet on August 6, and was allowed to set for 72 hours.

The plug was sidetracked successfully without a deflecting tool, using only a large drill collar, and the new hole, with proper angle and direction, was drilled to a measured depth of 5228 feet without using additional deflecting tools. Bottom at this depth was in the top of the green shale which overlies the D-3 zone. Seven-inch casing was run into the nine-inch hole, with extraordinary care being exercised to prevent repetition of the casing difficulties previously encountered on South Relief. Five thousand two hundred and twenty-five feet of casing were run into the hole in eight hours and 40 minutes, with cement then allowed to set for four days. Then drilling recommenced, with the smaller hole drilled down to a measured depth of 5340 feet or 30 feet above the top of the D-3.

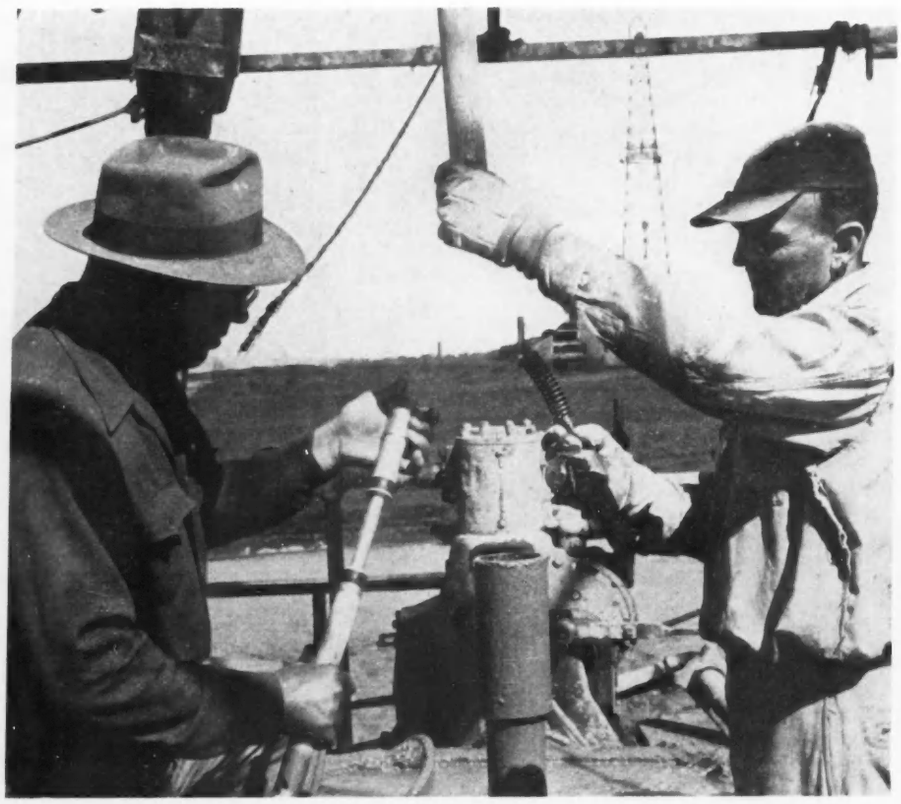
This depth was reached 69 days after engineers set the first whipstock in West Relief. During the intervening period, a total of 17 whipstocks were set, developing and maintaining a maximum angle of 18½ degrees from vertical. The true depth at bottom was 5237.51 feet, showing a loss in depth of 102.49 feet due to the lateral drift. Position of the bottom of the hole was less than five feet from the calculated bottom of the unsurveyed wild well, which, for lack of a determined position, was necessarily assumed to be vertical.

Initial plans for killing Atlantic 3 included efforts to establish circulation between the two wells through the green shale rather than risk drilling into the D-3 formation. Pump pressures were applied on August 30, but the impermeable formation refused to "take" water at a sufficient rate, and after several days, it was decided to proceed into the D-3 with the relief hole.

The decision to drill into the formation was made in the nick of time. First indication of impending changes in the condition of Atlantic 3 came on September 4, when with the surface soil spongy after weeks of seepage, the derrick over the wild well perceptibly leaned toward the south. Crews went into the area to jack up the low side, but it immediately altered its position, leaning toward the northeast. Undermined and weakened by such instability, during the pre-dawn hours of September 6, the derrick collapsed. With the knowledge that the fire hazard was immeasurably increased with the derrick structure in its fallen position over the crater, emergency crews were dispatched to the scene to construct additional restraining levees to prevent spread of a possible fire. Largely by virtue of this preliminary work, when the well became ignited later on this same day, the fire was localized and a sump with 70,000 barrels of oil from the wild well was saved.

On this day, West Relief drilled nine feet into the top of the D-3 and injection of acid and water was begun immediately. With available water lines, only 550 barrels per hour were injected; but steps were taken to lay two four-inch water lines to West Relief to permit injecting a maximum of 1350 barrels hourly, or nearly 33,000 barrels per day.

By noon on September 8, the larger lines were ready for use, and large volumes of water were being pumped into the D-3. At 4:30 a. m. September 9, or less than 17 hours later, the mammoth blaze belching from Atlantic 3 disappeared. At 6:00 the wild well became dormant. For the first time in many months, the wild well of Leduc was under control.



Preparing to survey West Relief well with an inside type single-shot instrument, which takes a directional reading inside a non-magnetic drill collar just above the bit. Frequent surveys were necessary to check the course of relief wells. Atlantic 3 appears in the background, with crater in left background.

Ras el Misha'ab
Arabian Desert Base Camp

Pioneer tent camp with kitchen in foreground.

THE STORY of the establishment of Trans-Arabian Pipe Line Company's base camp at Ras el Misha'ab is in a way a miniature of the history of the entire project of constructing a "big-inch" pipe line in the Arabian desert, since it was conceived as a part of the over-all project, and offered generally the same conditions and same obstacles as are to be met in most other phases of building.

Ras el Misha'ab is the port of entry and operational headquarters for the far-flung TAPline project, and the record of its building is interesting because although it is a relatively minor part of the over-all plan in terms of man-hours and cost, it gives an insight into the magnitude of such an undertaking as the construction of a major pipe line under difficult conditions. It might best be described in military terms, since it includes many of the steps of a military operation: planning, logistics, materiel, space-tons of shipping, establishment of beachheads, consolidation of position and operational headquarters. It may actually be considered as an invasion of foreign soil, though the natives were friendly and the only enemies were the swirling, choking sand and almost unbearable heat of the desert.

The location picked was most accessible to all points on the originally proposed route of the line, which was to extend for 1067 miles from its origin at Abqaiq field, principal producing center of Saudi Arabia, across northern Saudi Arabia, Trans-Jordan, Syria and Lebanon to a port at Sidon on the Mediterranean. The line was to have a capacity of 300,000 barrels daily and to be constructed of 30 and 31-inch pipe, and would save a tanker haul of about 3300 miles through the Persian Gulf, around the lower end of the Arabian Peninsula, up through the Red Sea and Suez Canal and through the Mediterranean to consuming centers of Europe and America. However, although the current political situation precludes the continuous deliveries of steel to the area for the entire line, work continues on segments of the project which will immediately connect outlying fields to the Persian Gulf ports and which will become an integral portion of the entire system when it is finally built.

Base of Operations

An examination of the coastline was made to select a spot for the base of operations. The site selected at Ras el Misha'ab satisfied the greater number of conditions. It lies approximately 150 miles northwest of the oil field area where partially protected water is deep enough for barges to approach the shore. From here, it is possible to reach almost all points on the pipe line route over gravel plains with heavy trucks. At that point the coast is an arid low-lying and uninviting desert almost completely devoid of vegetation and exposed to whipping sands which obscure the countryside during the "shamal" period. Little more than a year ago there were no inhabitants in the area except the occasional wandering Bedouin tribes who passed across it in their search for pasture for their goats and camels. There were no food stores, no lumber yards, hardware stores or filling stations. Just "wajid mafi" (plenty of nothing).

Today there is a modern city, small, but capable of housing and feeding 500 men, complete with garages, machine shop, warehouses, laundry, barber shop, office buildings, a 40-bed hospital, recreation hall and theater, harbor facilities and industrial plants necessary to the construction of the pipe line. A fresh water supply, salt water firefighting system, a modern sewage disposal system and air conditioning have been installed for the health and comfort of employes.

After determining what men and equipment were necessary to do the work involved in the construction of the line, details were first worked out in the U. S. regarding plans for camps, provision of food in proper quantities, purchase of equipment and spare parts, purchase of construction materials and maintenance supplies, forecasting of tonnage deliveries so that space could be obtained on ocean-going ships, plus the details incident to clearances, export licenses, permits from the Office of International Trade, etc. More than 5000 items, exclusive of spare parts, have been purchased and shipped, and when spare parts were included the total reached 30,000 separate items.

On June 19, 1947, the first group left for Saudi Arabia charged with the responsibility of receiving a small supply of camp materials, a few trucks, one bulldozer and a crane which had been sent on ahead to Arabian American Oil Company's port at Ras Tanura. With this initial complement of supplies and equipment the pioneer group opened the beachhead at Misha'ab. As soon as the equipment was unloaded and serviced the camp materials, bulldozer and crane were loaded on the trucks for the haul northward through the shifting dunes, across subkaha flats and over trails made by oil exploration

Ras el Misha'ab base camp showing skyhook towers in background.

parties. The caravan carried its own water, food and fuel because there was nothing at Misha'ab. The 150-mile trip took three days, and on the day after the party arrived and pitched its tents, the 'dozer was put to work pushing sand out into the Gulf to form a jetty where barges could be unloaded. The first ship appeared offshore August 13, anchoring 2½ miles out because of the shallow water. Unloading was accomplished with tugs and barges rented from a concern which performs lightering service at many ports in the Persian Gulf area. Within less than 24 hours 418 long tons of equipment and materials were placed ashore . . . a remarkable performance executed under difficult conditions.

Other ships followed in rapid order and construction work was started in earnest. A temporary camp, consisting of prefabricated wooden buildings mounted on wooden sleepers, was hastily constructed near the shore so that men could be removed from the tent camp. A small mess hall was built, followed with a recreation hall. A generator was put in operation to provide electricity for the camp; a section of one barracks building was set aside as a dispensary and hospital; a temporary sewer line was run out onto the flats to the north of the camp. Then construction of the main camp was started.

The main camp area is a mile square. Within this area, at the peak of construction activity, almost 400 Americans and 1500 Arabs were working on the various units which included the industrial facilities as well as living and service quarters. On high ground near the west edge of the camp 20 prefabricated barracks buildings were being erected. At the same time a permanent kitchen and mess hall capable of feeding 500 men at one time was being built on a concrete slab foundation. On the east-west main street of the camp a 300-by-100-foot warehouse was erected to house the thousands of boxes and cases piled in the warehouse yard. Just across the street a garage, machine shop and parts warehouse complete enough to service the entire job was built. Near the shoreline, on the east side of the camp area the pipe plant was assembled. This plant had been developed in the U. S. and was designed to weld automatically the 31-foot lengths of line pipe into 93-foot lengths. A transportation area was laid out near the pipe plant, where the huge trucks with eight-wheel trailers for hauling pipe, the smaller trucks, refrigerator vans, tractors, ditching machines and other similar equipment could be parked and serviced.

The original high tide pier, built by the pioneer crew, was lengthened and widened to accommodate two barges and facilitate the unloading of materials while a permanent causeway and pier were being constructed. The permanent causeway, built of rock and sand fill, extends 1300 feet into the Gulf for the accommodation of six barges at one time. The contract lightering was suspended as a small shipyard crew welded together the sections of prefabricated steel barges shipped from the U. S. to be erected in the field.

Meanwhile, a floating pile driver was working in the gulf, sinking piling for an artificial island 2½ miles offshore where the water was deep enough for berthing ocean-going tankers, and foundations for the "Skyhook" for transporting cargo from ship to shore. Originally developed as an aerial cableway for hauling logs from inaccessible locations in the Pacific Northwest, it has been adapted for this job to haul the thousands of tons of line pipe from the offshore dock to the storage area on land. The installation consists of a steel cable suspended approximately 80 feet above the water by wood towers spaced at 700-foot intervals and anchored to pile foundations driven securely into the coral reefs under water. Self-propelled cars, each operated by one man, move back and forth over this cable-way hauling pipe from the sea island to shore. Each car is capable of carrying three lengths of nested pipe, a load of approximately nine tons. The cars travel at an estimated speed of 35 miles an hour between towers and slow down to about 15 miles an hour when passing through the towers.

The nature of the terrain over which the line is being laid makes it possible

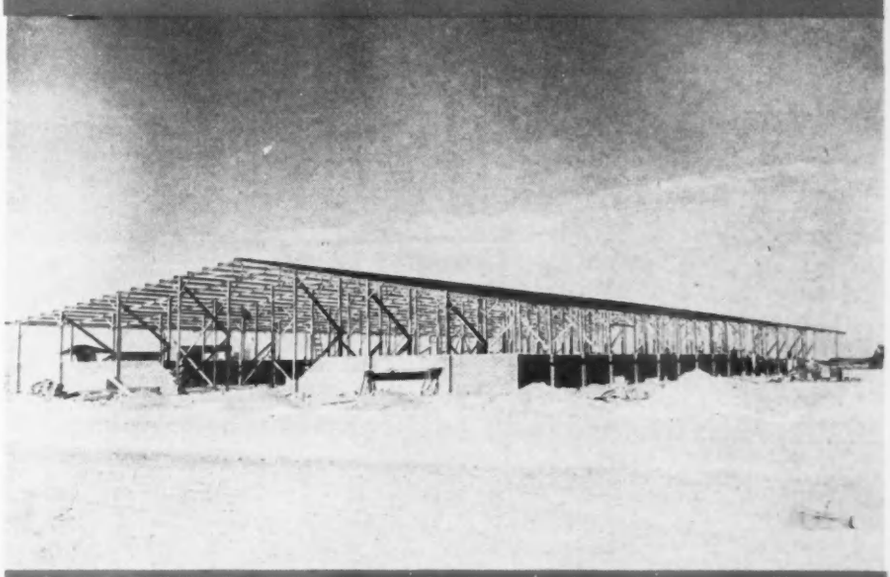
Removing coating used to protect trucks during ocean voyage.

for pipe to be transported on the huge trucks in lengths of three or four joints, or up to 124 feet. Since transportation of such lengths was feasible, it was decided that it would be much more economical to make them up at the base camp where handling machinery could be maintained, rather than in the field where much of the operation would have to be manual. The assembly of the pipe into 93 and 124-foot lengths is almost entirely automatic at Misha'ab. Pipe comes off the ships in 31-foot lengths with the 30-inch pipe nested inside the 31-inch to conserve shipping space. It is stacked near the pipe jointing plant until ready for use. A crane lifts the pipe from the stockpile to the entry ramp where Arab workmen roll it down the ramp to the denesting machine which separates the two sizes of pipe, sending the 31-inch on roller conveyors to either of two welding machines, and sending the 30-inch in the other direction to the other two welding machines. At each of these locations two lengths of pipe are placed end to end by a travelling car operated by compressed air, with the abutting ends directly under the welding head. Large clamps grasp the two lengths firmly and bring them into proper alignment before welding is started. The single operator moves the welding head into position over the joint, turns on the power to start the weld and simultaneously moves another lever which slowly revolves the two lengths of pipe, the molten metal filling the grooved joint as the pipe revolves. The car then moves down the track, picks up a third length of pipe, and repeats the process. It is inspected and tested after being moved to the loading ramp where the lengths are moved by truck to the right-of-way.

Completely aside from the practical aspects of the camp, the company has given a great deal of attention to the mental as well as physical comfort of employes. It takes into account the fact that a man in a foreign land 10,000 miles from home soon realizes he is a great distance from family and friends. Long periods of confinement within the camp area add to his loneliness and make him irritable. The constant presence of the same companions at work, in the mess hall and at night eventually adds to his irritability, and the acute discomfort of biting sands and intense heat aggravate the problem.

The completed camp shows that attention has been given to planning in an effort to lessen the discomforts. The barracks are divided into rooms with two men allotted to each room. Each man has his own bed with a fluorescent reading light. At the foot of the bed is a locker for his clothes and personal

First of the prefabricated barges awaiting completion of launching ways.



Main warehouse under construction.

Construction work under way on temporary camp near shoreline.

belongings. A card table between the beds and two arm chairs complete the basic furnishings of the room, although many of the men have placed Persian rugs on the floor and hung local trinkets or pictures on the walls. Walls and ceilings are soft green in color as a welcome relief from the tan and white glare of the desert. Each barrack is further equipped with a separate toilet room and a wash room containing adequate lavatories and showers. One small room, adjacent to the washroom, houses the central air conditioning unit. Cooled air is carried through wood ducts to each of the rooms during summer, and warm air during the winter.

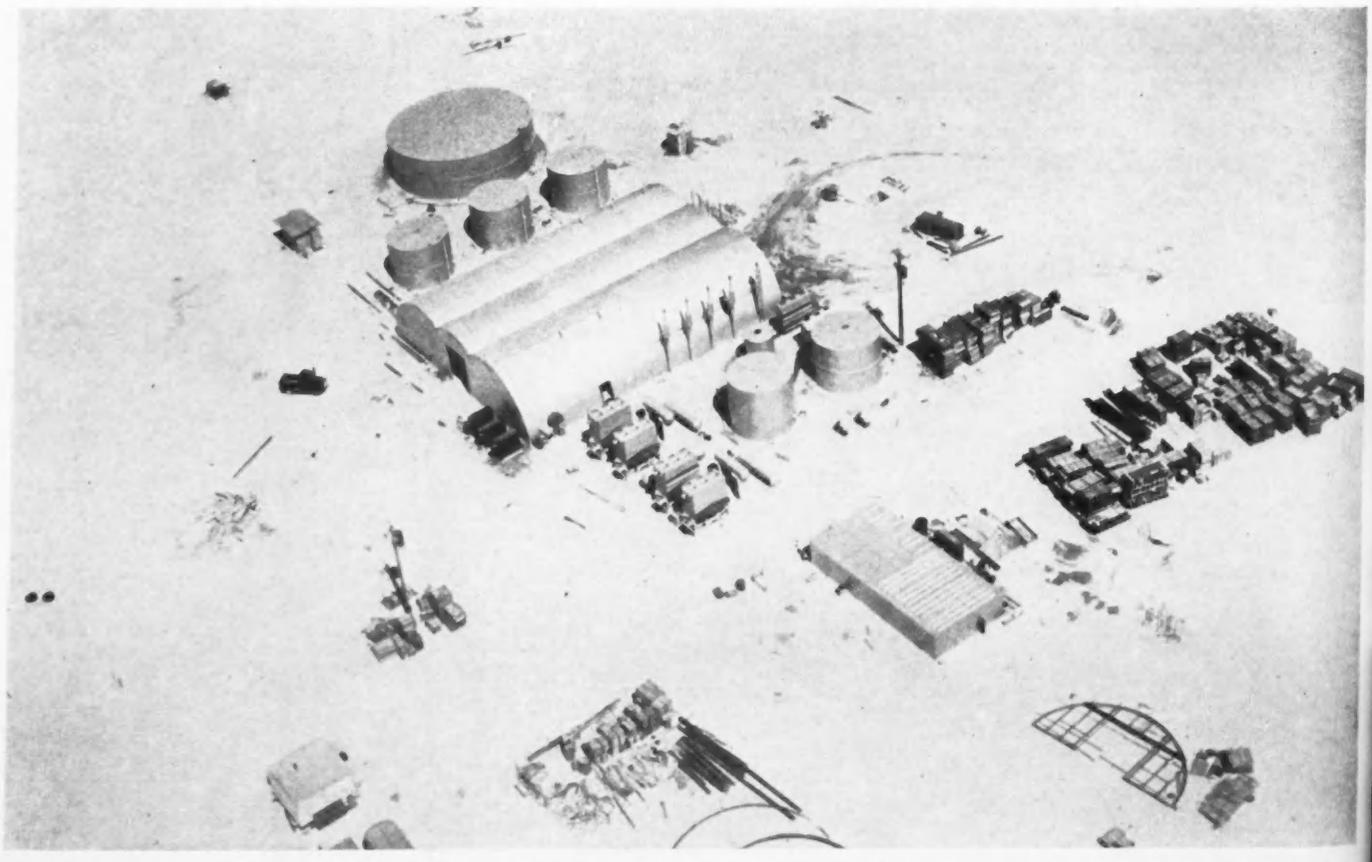
In the mess hall, Arab boys in white jackets and khaki trousers serve the men. White tablecloths on the tables at the evening meal give a more formal touch to the one leisurely meal of the day. The recreation hall contains pool tables, a bar where soft drinks and beer are served, a library and reading room, barber shop, shoe repair shop, and a commissary where workers may buy necessary toilet articles as well as clothing, tobacco and candy. An up-to-the-minute laundry does all the washing for the camp and provides a dry cleaning service at nominal cost. The hospital has a modern surgical department, complete dental facilities and five American women nurses. Eight 5-room houses have been built and completely furnished for a few of the executives who have brought their families with them.

The Arabs, of whom about 1500 were employed during the construction of the camp, are still an integral part of the maintenance and operation. Many of the skilled workmen used on the job received their training from the Arabian American Oil Company during its development of the oil fields and the operation of the refineries at Ras Tanura and on Bahrein Island. The unskilled laborers were largely Bedouins recruited from the wandering tribes to the west and south of Misha'ab. At first the language barrier hampered the coordination of work between the Arabs and the American mechanics. However, with the aid of interpreters the Americans soon picked up the few words of command and explanation necessary to mold the natives into an effective group of assistants. These men lived in their own tent camps on the sand dunes to the south of the main camp and adjacent to the shores of the Persian Gulf. Saudi Arab government customs and police officials also have been active in the life of the camp since its beginning. At first they lived in tents as did the Americans. Later plans were drawn for a customs building, living quarters for the customs officials and a home for the Emir, or local governor, a functionary who corresponds to a mayor in the U. S. The government indicated these buildings should be of a permanent nature so a local brick was developed by mixing subkaha clay with cement. Arab labor made thousands of these bricks, which were incorporated into buildings for the officials. The resulting structures with their flat roofs and overhanging eaves are similar to examples of good modern architecture in America. Set on concrete slabs and with well-insulated roofs, they provide comfortable living quarters in all seasons.

Difficulties Many

To the record of accomplishment must be added a note on some of the difficulties that attended the building of Misha'ab other than the natural and expected ones. Ships many times did not arrive on schedule; vital electric and other materials were delayed in shipment from the U. S. Fine sand sifted into engines and transmissions, putting equipment out of commission just when it was most needed. Reports of a cholera epidemic in Egypt and delays in mail delivery resulted in many resignations. At one time, almost half of the men in camp were off duty for a week with diarrhea. These and many other troubles were taken more or less in stride and the job was done.

The base has been of incalculable benefit in the pipe line construction already completed which connected Abqaiq field to loading terminal near Ras Tanura, and in that now under progress, through which the Abu Hadriya field is being linked to the Persian Gulf. If steel is made available for completion of the line to the Mediterranean, the base camp is now completely equipped to handle the job.

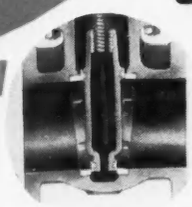


Main powerhouse containing water distillation units, central air conditioning equipment, electric generating equipment, and refrigeration storage.

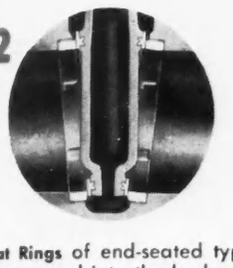
Reasons Why FOR WALWORTH

IRON BODY GATE VALVES

WITH SCREWED OR FLANGED ENDS

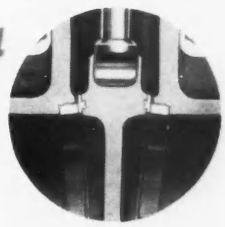


1 **Straight-Flow Port Design** reduces fluid turbulence to a practical minimum.

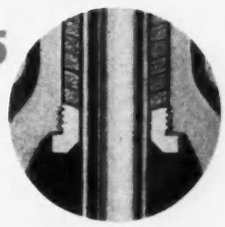


2 **Seat Rings** of end-seated type are screwed into the body.

3 **Sure-Grip Malleable Handwheel** for non-skid gripping even with heavy gloves.



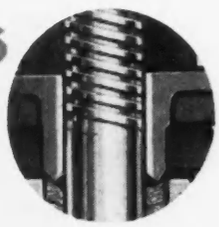
4 **T-head Disc-to-Stem** connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.



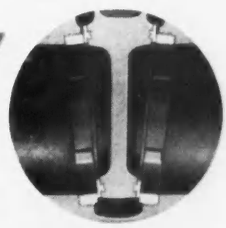
5 **Bronze Back-Seat Bushings** in bonnets of OS&Y valves.

WRITE FOR BULLETIN 106

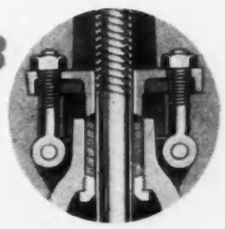
Bulletin 106 gives complete information on these new Walworth valves. Get your free copy from your nearby Jones & Laughlin Supply store or address a card or letter to our General Office—108 N. Trenton Ave., Tulsa, Okla.



6 **Brass Liner on Glands** assures greater resistance to corrosion and scoring.



7 **Solid Web Type Disc** in OS&Y valves for greater strength and longer service.



8 **Hinged Gland Eye-Bolts** on OS&Y valves permit faster, easier repacking under full pressure.

9 Sold by—

JONES & LAUGHLIN SUPPLY COMPANY

Stores and Offices in 17 States

Subsidiary of Jones & Laughlin Steel Corporation

General Office

TULSA, OKLAHOMA

J&L STEEL

Future of Colombia's De Mares Concession

General hospital maintained on De Mares concession for nationals and expatriates.

By GEORGE O. IVES
International Editor

THE submission of formal reports on the De Mares concession by outside consultants has again raised the question of final disposition of the property when Tropical Oil Company's concession expires in 1951. Reports from Bogota have indicated the government decided to take over the concession and operate it through its own agency. However, information available to WORLD OIL is that no final decision has been reached. Further, no final decision is likely for another two years or so, since the concession still has nearly three years to run, and conditions could change materially in the meantime.

The National Petroleum Council is still functioning in its advisory capacity, and reports by the consultants who made exhaustive surveys of the concession have been reviewed first by the council. After digesting the information contained in the reports, the council made recommendations to the Ministry of Petroleum. These have not yet been made public, and may or may not specifically advise whether the government should take it over August 25, 1951.

The rumor is again current that the concession will then be operated as a joint three-way enterprise, with interests being held by government, private national capital, and foreign capital. In this connection Petroleos Ariguani, a mixed capital firm, has again been suggested as possible operator, with the government retaining an interest which would be more financial than administrative. Whatever the final disposition of the concession in 1951, it is thought that right now the government itself is rather cool toward assuming such a responsibility should general conditions continue their present trend. The administration of a producing concession employing 3800 workers whose demands are apparently insatiable is anything but a pleasant prospect, particularly in the face of declining production.

The violence in Bogota of several months back has been described as a series of riots rather than organized revolution, but evidence points to organization with predetermined plans in the actions of some of the factions during the riots. The fields at both De Mares and Casabe concessions were taken over and held for a time by a group which termed itself a revolutionary junta. There seems to have been an impression on the part of most workers that on expiration of the present concession agreement they would share in the actual ownership of the fields.

Negotiations Deadlocked

With the expiration of the current labor pact at the end of June, negotiations were started between labor and management of all petroleum interests in Colombia in an effort to reach an agreement. Management was apparently willing to renegotiate with the understanding that the old pact should continue in force until some agreement was reached. Labor apparently wanted to retain the arrangement under the present condition of compulsory arbitration. Since the nation is still under martial law no strikes are permitted, and as long as the status quo is retained there will be no changes. At the time of most recent reports, the meetings were stalemated. Reports from the Colombian capitol say that labor's representatives at the discussions were instructed not to agree with anything, but to throw the meetings into a deadlock if possible. There now exists a decreed period of conciliation after which discussions are to be resumed. Meanwhile, the Labor Ministry takes no responsibility.

Little hope is expected for any amicable settlement since labor has stated a number of objectives which lead directly to management prerogatives on the part of labor, and all indications are that the companies will stand firm on these points. One demand is for a labor-management committee to pass on all hiring, firing, promotion and transfer of employes. Another is for absolute stability of personnel, meaning that once an employe reaches the payroll he stays, regardless.

Actually, the main underlying factor impeding solution of both labor and legal problems is thought to be the bitter political battle which has been in progress since before the present administration took office, and has been intensified in recent months. Every attempt is being made by reactionary elements to discredit the administration, and other matters such as labor irritations are thought to be surface indications of this program.

Since the Congress convened late in July, there has not been sufficient time to take any action on the proposed new

petroleum law, already passed by the House and now up for consideration in the Senate. The government is much more conscious that something must be done to make oil activity more attractive, since it is taken for granted among most observers that uncertainty as to the nature of the final statutes is one of the main reasons why exploratory activity has fallen off more than one-third in recent months. One disquieting report is that the Senate is likely to add compulsory drilling clauses in the law, practically dealing a death blow to exploration. A number of new provisions in the bill being considered tend to add materially to the cost of exploration, and another clause to force the drilling of a million-dollar wildcat on any concession granted would just about halt the applications for property.

Max W. Thornburg, who has served as a consultant in a number of Latin-American and other countries during the formulation of petroleum legislation, was retained by the Colombian government recently to advise on possible amendments and changes in the proposed law. He indicated at the time he arrived in Colombia that he would study the petroleum laws, as well as labor and tax laws to try to get at the reasons for slow development of the industry. After conferences with the Ministry and with Petroleum Council members and others, Thornburg is said to have indicated that he could not recommend a petroleum law along the lines they seemed to desire. At any rate it is unlikely that final action on the oil law will be possible at this session of Congress. It is now under study before being referred to the Senate Oil Committee for recommendation as to amendments or deletions, after which it must go before the Senate for final consideration and voting. It must then go back to the House. It is known that some amendments will be proposed by the National Petroleum Council and by the Petroleum Minister, so it is inevitable that much time will be consumed in its handling. While a possible unacceptable petroleum law may thus be postponed, it nevertheless lengthens the time of indecision on the part of the oil operators who must know what regulation will be in force before they can formulate plans for future activity.

Oil Shipped

During September two of Colombia's fields were scheduled to start shipping their first oil. The Shell Group was scheduled to complete its pipe line outlet connecting El Dificil field to the Andian National Corporation's line at Plato Station. The initial deliveries through the line were expected to run in the neighborhood of 3000 barrels daily from 13 producing wells. However, some of the most recent completions have shown potentials of around 2000 barrels each on preliminary tests, and offtake from the field may be greater than the 3000-barrel estimate.

Texas Petroleum Company's base camp on the Caqueta River. In southernmost Colombia, this area is accessible only by air.

At about the same time Texas Petroleum Company was expected to move its first oil from its Velasquez field on the Teran-Guaguaqui fee property. A short line has been built from the vicinity of the two producing wells to the Magdalena River at Puerto Niño, and oil is to be transported by barge. Quantities will be relatively small and are destined principally for refinery test runs.

Cantagallo Shipments Gain

Socony-Vacuum Oil Company's deliveries from the Cantagallo field have been steadily increasing from the original rate of 800 barrels daily from three wells. Under actual producing conditions it has been found that one of the wells alone can efficiently maintain a flow of 1300 barrels daily, one of the best individual producers in Colombia. Unfortunately, the field has been extensively prospected by drilling of deep tests and structure holes, and very little area is available for the drilling of additional producing wells. Recently the company acquired a concession immediately to the east of the Cantagallo tract, including part of the Magdalena River bed, and plans are under way for exploratory drilling in that direction. The field itself is an accumulation against a clearly defined major fault with the producers located in a narrow segment along the bank of the river.

New Wildcat

An interesting exploratory effort is being carried out by Texas Petroleum in a hitherto unprospected part of Colombia. The company recently completed a shallow test, Solita 1, as the most southerly wildcat for oil ever drilled in the nation. On the Caqueta River near the Ecuador border, the well was drilled almost exactly on the Equator. Although only a little more than 250 miles from the Pacific Ocean, it is across the Andes Mountains where its heavy equipment must either be flown in piece by piece in amphibious planes, or must come all the way from the Atlantic side of the continent up the Amazon River. The Caqueta is one of the principal tributaries of the Amazon system, and its headwaters rise within 50 miles of the Pacific. Although the Solita 1 was dry, definite showings of heavy oil were found, and another test is being drilled in the general area. The Rastra 1 about 30 miles northeast was drilling below surface casing. This is an interesting, and expensive, operation. Located in heavy tropical jungle country without means of travel other than by water, the camp has been constructed on pontoons so it can be moved from place to place with a minimum of dismantling. It is towed in sections up the devious waterways and secured as near the drilling operation as possible. Regular flights of the company's amphibious plane keep it supplied and furnish transportation for personnel.

Workers recruited from such villages as Cantagallo, above, are housed in modern quarters at oil company camps.

Emsland Area

Center of

Dutch-German Dispute

ONE of the most promising oil provinces in Western Europe has become the subject of serious controversy in recent months, particularly in Dutch and German oil circles. A substantial portion of the Emsland area has been claimed by The Netherlands as their territory, and recently the Dutch Government has explicitly declared that it intends to maintain and assert its territorial claims against Germany. Actually it is understood that the specific delimitations of the area finally to be ceded to the Dutch are named neither in the recent statements of the Dutch nor in the recommendations of the Six Power Conference. Consequently there is some question as to whether or not the original territorial claims will be maintained, or whether the considerable area under discussion is to go to the Dutch.

In the absence of a formal delineation of the area under discussion, the exact property to be affected is not known, but the accompanying map shows an area outlined in a map published by the Dutch paper "Vrij Nederland," which pointed out the shaded area as that to which the Dutch laid claim and the heavy line as the proposed new border line. The area claimed would include all of the production in Germany's Emsland in addition to the site of many promising salt dome and anticlinal structures.

Recently it was learned that the Allied Powers will send a commission formed by representatives of the United Kingdom, U. S., and The Netherlands to the border area for the specific purpose of investigating the oil question which is apparently one of the important parts of the Dutch claims.

Regardless of the outcome of the controversy and final disposition of the area, it is indeed a valuable area from the standpoint of petroleum reserves, particularly in view of the scarcity of oil in that part of Europe. The question is assuming more importance with late drilling experience which shows that the Schoonebeek field on the Dutch side and the Emlichheim field on the German side are both of greater importance than first supposed. The production from the Netherlands portion is now up to approximately 8000 barrels daily and gives promise of being capable of satisfying all of the internal needs of the Netherlands within a comparatively short time. The production from the Emlichheim, Georgsdorf, Lingen, and Adorf fields on the German side has increased steadily to approximately 3000 barrels daily during the first seven months of 1948, with an assured increase in the production for the year over 1947. It is estimated that within five years the Emsland would be producing more than 75 percent of all of Germany's oil. Present estimates place reserves of the four fields on the German side at 65 to 85 million barrels. A further problem which would arise with cession of the area to Holland is that of the disposition of the British and American interests in the operation of some of the German concessions.

Shaded area along Dutch-German border is claimed by the Dutch under Potsdam agreement and includes all of Emsland oil production.

Germans following the progress of events have the feeling that the Dutch were grievously wronged by the assault and occupation under the Hitler regime, but have expressed the attitude that annexation of the Emsland by the Dutch would not be in keeping with the wording of the Potsdam agreement which reads that "Reparations should not be paid from the means of production but from the production itself." Whatever the decision of the Allied Powers, the Dutch or the Germans will hold one of the most valuable of the new favorable oil areas in Western Europe.

Co-Ops

Enter International Field

FOR what is believed to be the first time in the history of the industry, cooperatives and private enterprise have joined to create a commonly-owned and virtually integrated oil company. In the recent organization of Petrol Refining, Inc., is seen a new and signficant development in the cooperative movement in the American petroleum industry, affecting both domestic and international operations. The new company already has negotiations under way for the acquisition of crude from foreign countries, principally Venezuela, on a barter basis for grain and other products available to the cooperatives. The concern has been formed jointly by three of the largest cooperatives in the U. S., together with Petrol Terminal Corporation.

The three cooperative partners in the enterprise are the Grange League Federation of Ithaca, N. Y.; Southern States Cooperative of Richmond, Va.; and the Pennsylvania Farm Bureau of Harrisburg, Penn. Petrol Terminal is a new private oil company organized and headed by Eugene Callis, formerly president of The Petrol Corporation of Philadelphia, who becomes president of Petrol Refining.

The new four-partner Petrol Refining, Inc., is a $10 million concern that will import Venezuelan crude and process it in addition to Texas and Louisiana crudes for the distribution of petroleum products to ¾ million customers in 14 Eastern states. A total of $6 million already has been paid in, and the balance is committed to the four partners. No stock will be offered for public sale.

An unusual feature of the operations will be the projected program of bartering U. S. grain shipments for Venezuelan crude.

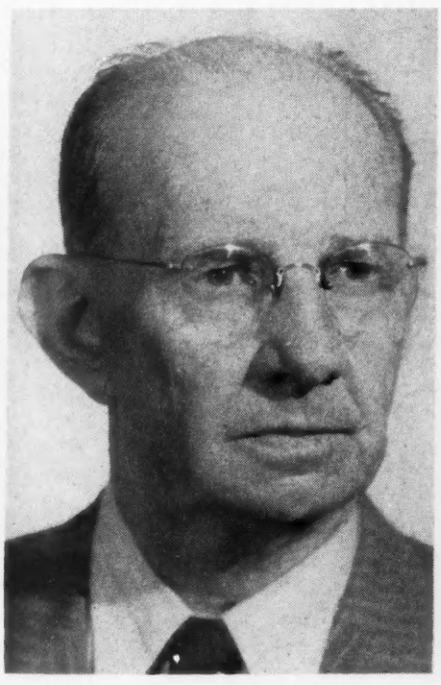
Petrol Refining announced that it will import 800,000 barrels of crude monthly from Venezuela and has established connections for 400,000 barrels monthly from Texas and Louisiana producers. The corporation has acquired and will operate two refineries, one a fixed bed at Texas City and a toulene plant built by War Assets Administration at Beaumont, Texas. The Beaumont plant is now in process of dismantlement for removal to Texas City. The Texas City plant is currently running 17,000 barrels a day, and when both plants are in scheduled operation, they will top 50,000 barrels a day and finish 32,000 barrels a day.

Petrol Refining has acquired three T-2 tankers from the Maritime Commission, has one other T-2 on charter operation and a fifth employed on trip basis. Petrol Terminal itself has 1 million barrels capacity storage at Baltimore, with secondary storage at Washington, Wilmington, and Salisbury, Md., totaling another million barrels. It will store product in these various tanks for its own use as well as for that of the three partner cooperatives.

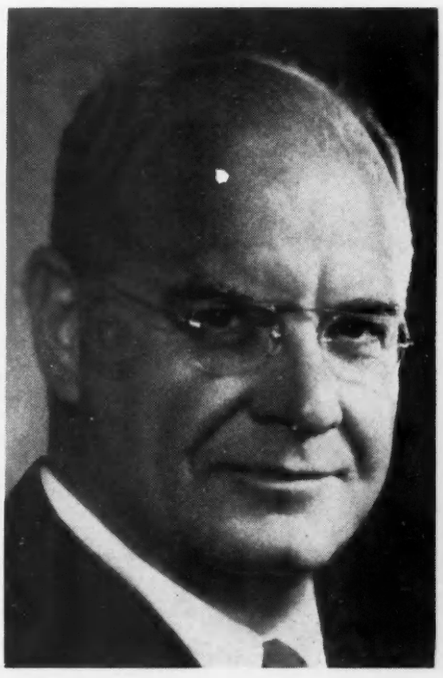
Origin of Plan

The unique plan originated during the shortage period of last winter when Petrol Corporation, then headed by Callis, was supplying among other customers the three cooperatives. When Petrol was unable to fulfill commitments to the cooperatives, pressure was applied, says Callis, by Senator Wherry's Senate Small Business Committee, and Callis and the cooperative leaders discussed a program of supply. Meanwhile, Callis had sued the government for losses arising under extra-transportation costs of wartime materials and was awarded $3,800,000 damages by the Congress. The bill validating the claim was later vetoed by President Truman. Callis had bor-

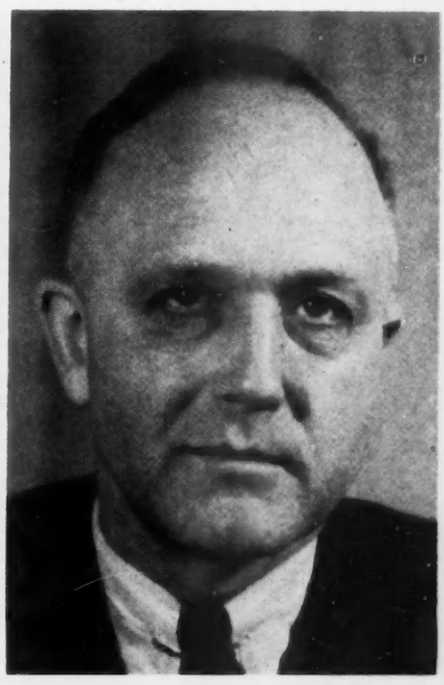
■ CONTINUED ON PAGE 233



V. E. SMITH



EUGENE CALLIS



V. A. FOGG

Discovery Spurs

Mexico Exploration

REYNOSA Well 2 has been completed by Petróleos Mexicanos (Pemex), Mexico state oil monopoly, with a reported daily production of about 1000 barrels of very light, 62 gravity oil. No. 2 was drilled in shallower sand to 4628-4637 feet near the discovery well, Reynosa 1. The No. 2 is reported to have tested over an eight-hour period and to be producing under a reservoir pressure of 1975 pounds per square inch.

Both wells give hope for significantly increased production in Mexico and the discoveries climax two years of intensive search in northeastern Mexico from Matamoros to Camargo.

Meanwhile, pending contract negotiations between a number of American oil companies and Pemex made little headway during September. It is understood that arrangements are pending with Sun Oil Company, Signal Oil & Gas Company, Phillips Petroleum Company, Continental Oil Company, The Texas Company, and several others.

Contrary to previous reports, it is understood that Cities Service Oil Company is not encountering difficulties with Pemex over the contract already signed, and there is considered no likelihood of abrogating the Cities Service contract.

Some impetus to the conclusion of deals with American companies was believed given by the visit to Mexico of five members of the House Interstate and Foreign Commerce (Wolverton) Committee. The American Congressional delegation visited the Mexican fields and refineries. Chairman Wolverton was quoted in Mexico City newspapers as saying:

"We are not here to give orders or to tell Mexico how to produce more crude. We are here to see if we can assist Mexico in increasing production so that more Mexican oil can flow into the oil-short machines of the U. S." Wolverton was quoted as expressing hope the U. S. can furnish Mexico drilling rigs, casing, pipe and refinery equipment.

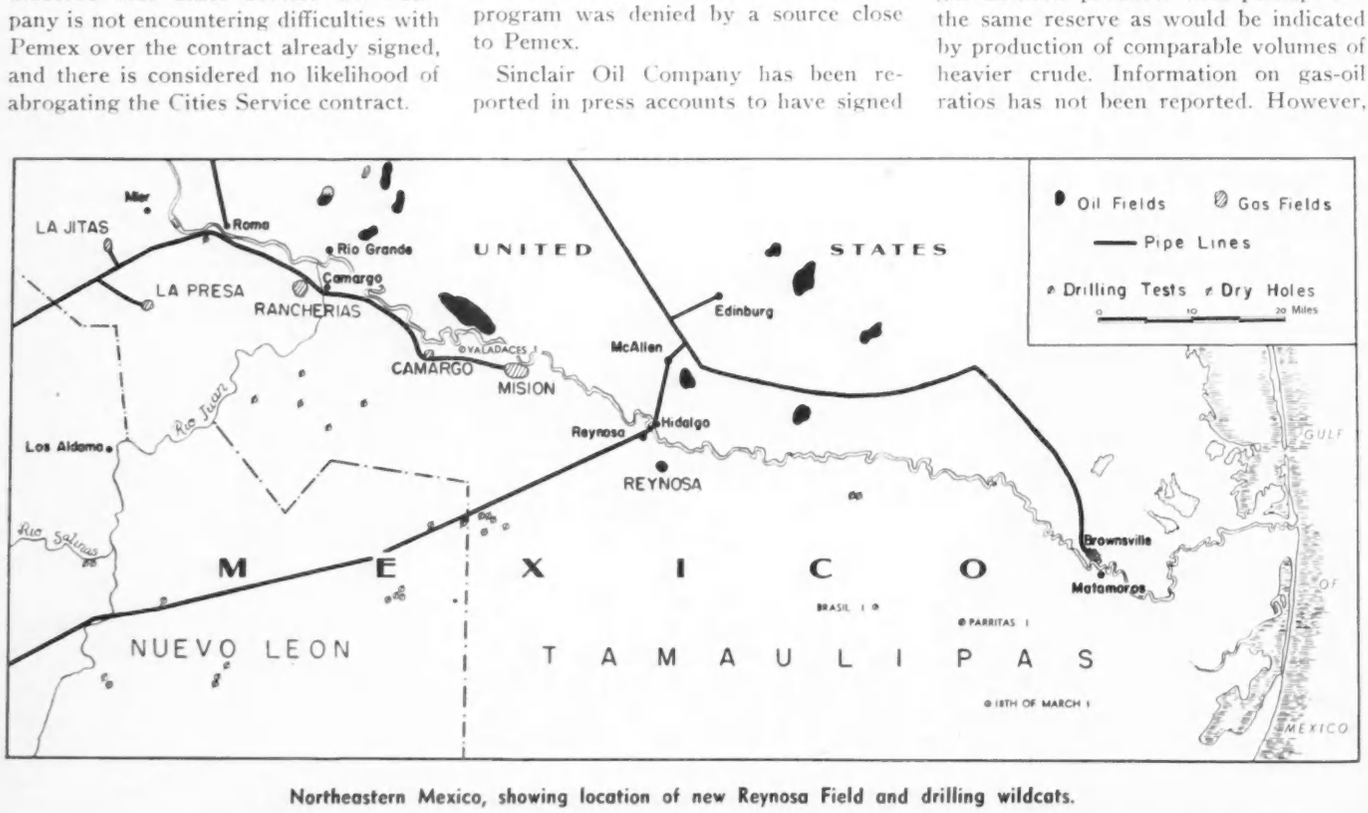
Program Denied

Mexican papers reported Pemex is planning to drill new wells in Molocan, Punta Gorda, Vernet (old fields in the Isthmus zone), and in Huimanguillo and Encrucijada (in Tabasco), but such a program was denied by a source close to Pemex.

Sinclair Oil Company has been reported in press accounts to have signed for the purchase of 9,800,000 barrels of oil from Pemex to be delivered during 1949 and 1950 in Cuba and at the Pennsylvania refinery, at a price of $2.46 a barrel. However, Antonio J. Bermudez, head of Pemex, denied that such a contract had yet been signed.

Bermudez stated, according to the Petroleum Workers Union, that Mexico will pay its petroleum debt to England in cash, not in oil. This action would settle claims resulting from the expropriation edict of 1938.

Opening of a new oil field with the producing potential indicated by the two wells at Reynosa is of particular importance to Mexico at this time, when its fields are producing at very near the optimum rate. It is much too early to make any attempt to estimate the amount of reserve or probable producing potential of the new Reynosa field, but the gravity of the production and the character of the formations encountered elsewhere in this general area would indicate that the field is to be largely a gas-distillate producer with perhaps not the same reserve as would be indicated by production of comparable volumes of heavier crude. Information on gas-oil ratios has not been reported. However,



Northeastern Mexico, showing location of new Reynosa Field and drilling wildcats.

the outlook is enhanced considerably by the possibility that it will be a multiple-sand field. A further addition to the value of the discovery is its proximity to existing gas transmission lines leading to a substantial market in the Monterrey district.

Reynosa 1 is producing from a perforated section at 7070-78 feet, and on the basis of short tests made necessary by the lack of pipe line outlets was estimated as a 1000-barrel-a-day producer flowing through ¼-inch choke under pressure of 2133 pounds and making 50-gravity oil, with a considerable volume of gas. After finding sands at 7000-100 feet, casing had been set at 7116 feet and the well drilled to a final total depth of 8113 feet before coming back up the hole for the production tests resulting in completion.

Production is tentatively identified as from the Vicksburg member of the Oligocene formations, and authorities are still withholding final judgment since a showing of wet gas in Tertiary formations is not uncommon in wells previously drilled in the area.

The second well, less than 200 feet from No. 1, was spudded early in July after the first well had found the sand and before it reached final depth. It was only carried to 4660 feet before being completed, and did not go on to any of the deeper horizons. Its producing formation is probably non-marine Oligocene above the Vicksburg.

Outpost Spudded

Meanwhile, Pemex has started an outpost, Reynosa 7, about a mile southeast of the discovery well which will furnish important information regarding the probable extent of the new structure.

Wildcat activity continues up and down the border from Reynosa with three wildcats now being drilled, all of which have reported some showings of oil or gas. About eight miles northeast of the Camargo field and across the border from the Sam Fordyce field in Texas, Pemex has set casing at Valadaces 1 in the extreme northwest corner of the State of Tamaulipas. Total depth is 6227 feet with seven-inch casing at 6220 feet.

Other wildcats in the immediate area include the Pemex 18th of March 1, southwest of Matamoros, drilling below 10,150 feet and reported as having shown indications of oil in the Tertiary; and Pemex' Brasil 1, west of Matamoros which is drilling below 6900 feet in sand and has also reported showings.

Elsewhere in Mexico, the Pemex exploratory program seems to be gaining some momentum. With comparatively few proven drillable locations in producing areas, more attention is being given to wildcats, extensions and deep tests, with the result that of the 46 wells completed since the first of the year, 19 have been of an exploratory nature.

During May, the latest completed compilation of production, Mexico's production reached a total of 5,005,839 barrels, an average of 161,479 barrels a day, the highest it has reached in about 20 years. As usual, Poza Rica accounted for the greater portion, its output having been 2,933,425 barrels, or at the rate of 94,627 barrels a day during the month.

The fact that Mexico has reached a new 20-year peak in production would seem to be at variance with the great concern felt by Mexican officials, but it must be noted that the production record shows no new fields of any consequence. The increase has been due entirely to increasing output from existing fields, now very close to their estimated full capacity. Any further substantial increases would seriously endanger the future life of the producing area. A program is now under way to increase the use of pressure maintenance in the Poza Rica field, and with realization of this plan it may be possible to produce this field at upwards of 120,000 barrels daily.

Co-Ops Enter International Field

■ CONTINUED FROM PAGE 229

rowed from Cities Service Company, which in default of payment by Callis took over Petrol Corporation. Thereupon Callis organized Petrol Terminal, Inc., present partner in the new cooperative venture. Petrol Terminal retains about 150 wholesale customers from Petrol Corporation.

Petrol Refining, Inc., will be located at 1106 North Charles Street, Baltimore; and officers of the corporation, besides President Callis, are W. G. Wysor, board chairman; V. A. Fogg, board vice chairman and vice president of the corporation; V. E. Smith, vice president in charge of manufacturing; F. F. Sweeton, vice president in charge of crude oil and transportation; Wilmer G. Williams, secretary; John W. Presson, treasurer and controller; E. W. Hurst, assistant secretary. Directors are E. V. Underwood, W. S. Miller, V. A. Fogg, H. S. Agster, R. N. Benjamin, William H. Fetter, W. G. Wysor, W. T. Steele, Jr., O. E. Zacharias, Jr., E. M. Callis, F. F. Sweeton and V. E. Smith.

Just prior to the formation of Petrol Refining, Inc., other significant developments were unfolding in the international petroleum cooperative movement. The first cargo of Middle East crude ever purchased by a U. S. cooperative was on its way to the Consumers Cooperative Association of Kansas City. The 115,000-barrel shipment was purchased from Anglo-Iranian Oil Company, Ltd., 55 percent of the stock of which is owned by the British government. Another similar shipment will be made in November, cooperative officials announced. Howard A. Cowden, president of Consumers Cooperative, said:

"This importation of Middle East crude completes the chain of co-op international trade in petroleum. It began with shipments of lubricating oils and greases to co-ops in Europe, Africa and Australia, first by CCA, and then after it was established in 1947, by International Cooperative Petroleum Association."

CCA imports of Middle East crude will be processed in co-op refineries or exchanged with an Eastern refiner for Midwest crude, Cowden said.

Cooperatives now distribute 20 percent of petroleum products used on farms and they own 18 refineries with a total capacity of 103,150 barrels a day, exclusive of the Petrol Refining, Inc., two plants.

The world cooperative movement has been actively interested in the international petroleum picture. The International Cooperative Alliance was to meet in Prague, Czechoslovakia, late in September, to draft a proposal that the United Nations study world oil resources. Previously, in October, 1946, ICA proposed to the United Nations that a world oil control program be set up, but this plan was rejected.

American cooperatives have announced they will fight any attempt by Congress to quitclaim title to tidelands oil. Representatives of 22 regional co-op associations so voted in Kansas City in August, contending "Federal control of tidelands and the continental shelf is imperative if the public interest is to be served." The co-ops there assembled decided to name a five-man committee to employ a fulltime representative who would meet with Gov. Thomas A. Dewey and President Truman.

Cooperative world trade in petroleum has been handicapped during the last year because of dollar shortage abroad and import quotas imposed by the U. S. With a readjustment of dollar inventory abroad, Lloyd N. Marchant, manager of International Cooperative Petroleum Alliance, predicts that in the next year the alliance will acquire one or more refineries overseas. In evidence of the growth of cooperatives abroad, Marchant said: "While Swedish cooperatives have only been in business for ten years, they are already distributing 20 percent of the oil products consumed in Sweden."

Production Up in

Persian Gulf Area

DESPITE the long tanker haul from the Persian Gulf oil terminals around the Arabian Peninsula and through the Suez Canal, the increased availability of tankers plus coordination of movements have made possible substantial increases in production from the Persian Gulf area.

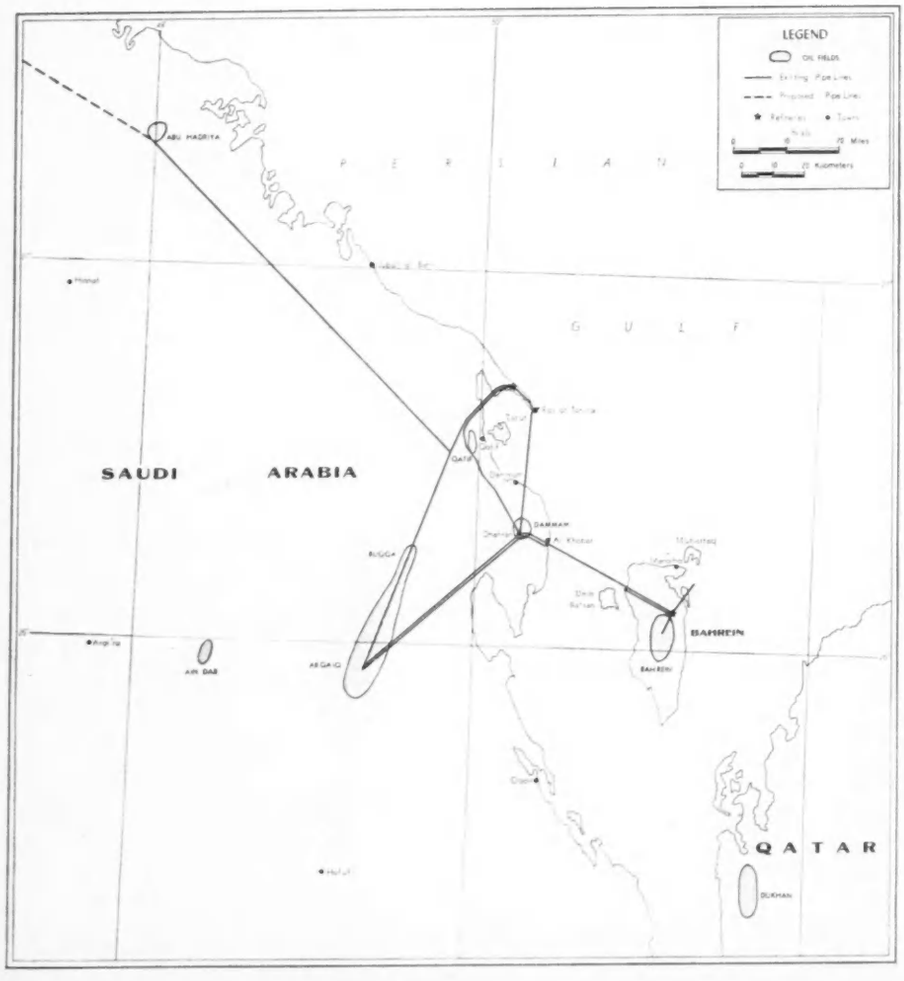
The most outstanding increases in total output have been from Saudi Arabia and a new discovery at Ain Dar shows considerable promise. The Saudi Arabian fields at the beginning of 1948 were producing a total of 305,000 barrels of crude oil daily, about half of which was being processed through the Ras Tanura refinery, and the balance through the Bahrein Petroleum Company's refinery on Bahrein Island. The Bahrein refinery is supplied with crude through submarine lines from the vicinity of Dhahran. By the middle of 1948 Saudi Arabia was producing 410,000 barrels a day, and even this figure was increased during the month of July to a daily average of 420,000 barrels early in August. This represents an overall increase in production amounting to nearly 38 percent since the beginning of the year.

With seven drilling rigs in operation expanding the limits and producing capacity of Abqaiq, and the potential suggested by the new discovery at Ain Dar, the actual ability of the fields to produce has already outstripped the facilities for handling and shipping crude. Operators now estimate that despite continual pipe line and terminal construction, very little additional output can be attained unless tankers become available in greater numbers and port facilities can be constructed to handle loading. The Tapline, 30-31-inch carrier proposed to deliver in excess of 300,000 barrels daily to a Mediterranean port at Sidon, would furnish the most immediate answer to the transportation problem, but the time at which this project can be built in its entirety is doubtful on account of political disturbances in the Arab states.

An accurate evaluation of the Ain Dar discovery, 27 miles west of the Abqaiq field, cannot be made until the well is completed and a record of the section is compiled, but preliminary information indicates that it will be of first magnitude. The well has already drilled 250 feet of pay, topped at a depth of 6585 feet, in one of the zones of the Lower Arab limestone. It was drilling ahead for a close study of the entire producing section before being completed. The pay corresponds to the "D" zone at Abqaiq field, and the thickness of pay compares favorably with any field in Saudi Arabia even if no more is found. While no information is available as to the possible size of the productive area which might be opened up by this wildcat, it opens up a trend for additional wildcatting which should result in the discovery of other fields. It is located on a line of folding trending north and south which has been traced for a length of more than 125 miles.

The discovery of this new area may cause a revision in the current drilling program where five of the company's seven rigs are being used in the development of proved areas in the Abqaiq field, and only one rig at a time being operated in wildcatting operations. The other rig is one of the two being used in outpost or semi-exploratory wells to establish the limits of the producing area at Abqaiq and elsewhere. There will probably be several wells drilled at Ain Dar to partially establish its limits, and wildcatting should continue along the trend of folding.

At Abqaiq the current development program is staying in advance of the transportation facilities. At the beginning of the year the 200,000 barrels daily production was coming from only 17 wells, since ten of the producers had not yet been connected into the gathering system. Most of these, and others completed during the year, have been connected now, but it is only recently that pipe line capacity in sufficient volume was made available through completion of the new 30-22-20-inch system to Qatif Junction and Ras Tanura, furnishing an additional 326,000-barrel outlet. Now the big field has pipe lines sufficient to carry a total of 531,000 barrels of crude oil to the Gulf at Dhahran and Ras Tanura, and is bottle-necked at that end by tanker shortages and berthing facilities.



STOKVIS---LOOK! AND LISTEN!

A NEW 125 TON KING

No Washpipe
No Packing Gland
No Stuffing Box

75RP Swivel

Swivel is narrow—11¼"; short —65" o.a.; and light—740 lbs.

Single moulded packing ring of tough, wear resisting rubber, automatically seals against an extremely hard wear bushing to give you long trouble free service.

Packing and wear bushing removed and replaced within five minutes, without removing any other swivel parts.

Alloy steel throughout except a few minor parts of manganese bronze. Angular—Contact Ball Bearings. Bail or elevator stock optional. Supplied with 4½" or 6⅝" pins.

- No washpipe
- No packing gland
- No stuffing box

75RP Swivel

KING SWIVELS

Type Swivel	Cap. Lbs. at 100 R.P.M.	Safe Load Limit, Lbs.	Weight, Pounds	Length, Inches	Width, Inches	Bail Opening	Lower Connection	Hose Connection	Diameter Water Course
10-LV	14,000	20,000	35	20½	5⅝	2¼"x3¾"	1½"	1½"	1 3/16"
10-PD	14,000	20,000	38	20½	12	2¼"x3"	1½"	1½"	1 3/16"
20-GW	40,000	80,000	90	32	6¾	4"x8"	2⅞"	2"	1½"
32-GA	64,000	120,000	170	42	9¾	6"x14"	3½"	2"	1½"
53-GA	110,000	200,000	340	52	12¼	8"x20"	4½"	2½"	2"
75-RP with 4½" connection	150,000	250,000	740	65	11¼	8"x18"	4½"	3"	2½"
75-RP with 6⅝" connection			780	66	11¼	8"x18"	6⅝"	3"	2½"

See pages 2129-2140 of 1948 Composite Catalog

KING OIL TOOLS, HOUSTON, TEXAS

EXPORT REPRESENTATIVES

R. S. STOKVIS & SONS, INC.

17 Battery Place

NEW YORK 4, N. Y.

Established 1844

R S NEW YORK

R S NEW YORK

Production Gains

Reported in Brazil and Egypt

BRAZIL'S production in July surpassed that of June and the previous two months and reflected improved conditions in the Candeias fields and renewed output from Dom Joao's one well. Candeias had six producers in June, eight in July. Itaparica and Pitanga fields are not reactivated.

Egyptian production was also considerably increased in July, reporting 1,061,618 barrels as compared to June's 698,549 barrels.

Germany's production for June was lower than the figures reported for either May or April. In the past six months the Emsland fields have accounted for most of the production, and the output from Nienhagen, formerly principal producer, is declining.

Last available reports from Pemex in Mexico showed slight but steady increases in production as the year progressed. April's output was bettered by 360,760 barrels, as the 161,479-barrel daily average for May set a new 20-year record.

Increase was also evident in Polish production and was due principally to new wells and the deepening of existing wells. In May the daily average output per well was 1057 barrels, while in June this figure was upped to 1092 barrels. In the first half of 1948, the output of crude oil was 471,268 barrels, some 40,544 barrels more than in the corresponding period of 1947.

Latest reports from Soviet Russia say that production plans of the oil industry were "overfulfilled" by 4 and 7 percent in the first and second quarters of 1948 in the western and southern areas and by 6 and 10 percent respectively in the eastern areas of the Union. Compared with the same period of 1947, the output in the second quarter of this year rose by 15 percent for crude oil, 16 percent for gasoline, 17 percent for kerosine, and 9 percent for natural gas.

Yugoslavia's domestic oil consumption is now reported to be considerably higher than the prewar 1 million barrels annually, but its production, though reported as showing a 14 percent "overfulfillment" of the Five-Year Plan in 1947, is believed to be far below consumption.

Kuwait, in the Persian Gulf area, reported daily average production of 123,050 barrels during the month of July. This figure is being stepped up continuously as handling facilities and tankers become available, and is reported as having reached 150,000 barrels near the end of August. With production for the first seven months of the year already greater than the entire year 1947, it seems likely that Kuwait will show an increase of more than 150 percent in 1948.

Iran, even though its increased facilities for delivering crude from Agha Jari to Bandar Mashur are not yet completed, has reached a daily average of 564,800 barrels, some 92,800 barrels daily more than it was producing at the end of 1947.

Creole Petroleum Company, largest producer in Venezuela, which produced 629,761 barrels a day during July, is continuing the average of 630,073 barrels maintained throughout the entire first six months of 1948.

Crude Oil Production

COUNTRY	COMPANY	PRODUCTION Month	PRODUCTION Barrels
Brazil	Conselho Nacional do Petroleo	June	10,376
		July	14,551
Ecuador	Anglo-Ecuadorian Oilfields	July	116,907
	British-Controlled Oilfields	July	56,565
Egypt	Anglo-Egyptian Oilfields	July	1,061,618
Germany		June	348,565
Iran	Anglo-Iranian Oil Co	July	17,508,327
Kuwait	Kuwait Oil Co	July	3,814,541
Mexico	Petroleos Mexicana (Pemex)	May	4,746,250
	Mexican Gulf	May	50,945
	New England	May	25,291
	Miscellaneous	May	183,353
Peru	Lobitos Oilfields	July	216,167
Poland		May	77,871
		June	80,906
Trinidad	Apex (Trinidad)	July	273,252
	Kern Oil Co.	July	40,708
	Trinidad Central	July	45,553
	Trinidad Leaseholds	July	524,996
	Trinidad Petroleum Development	July	223,318
	United British Oilfields	July*	507,299
Venezuela	British Controlled Oilfields	July	31,621
	Colon Development Co.	July*	406,435
		August	315,899
	Creole Petroleum Corporation	June	19,522,590
	Venezuelan Oil Concessions	July*	11,163,715

* Five weeks ending August 2.

Walter Keefe Named Manager For Mene Grande Oil Company

Walter L. Keefe, who has served with the Mene Grande Oil Company in Venezuela for 21 years, has been appointed manager of the Eastern division with headquarters at San Tomé, succeeding Robert L. Boggs. Boggs is temporarily handling the duties of Western division manager at Maracaibo while I. G. Davis is on leave in the U. S.

Keefe has been with the Gulf companies for 28 years, having gone to Mexico with the company shortly after graduation from Pennsylvania State College. Transferred to Venezuela in 1927, he served as shop foreman, field foreman, and chief petroleum engineer in the Western division for about five years before being moved to Eastern Venezuela, where he was assistant superintendent of the Production department. From 1937 until the time of his recent promotion he had been general superintendent of the Production department.

Cliff W. Peery has been named general superintendent, Production department to succeed Keefe, moving up from assistant superintendent, a position he has held since early this year.

Chapter Five of THE SCHLUMBERGER STORY

What do *YOU* call Service?

We at Schlumberger believe it is:

SOUND RESEARCH

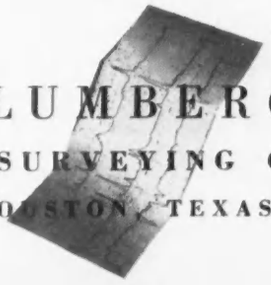
GOOD ENGINEERING

WELL MANUFACTURED EQUIPMENT

WELL TRAINED, EFFICIENT PERSONNEL

A GOOD PRODUCT AVAILABLE WHEN NEEDED

With the firm belief that *only good service is service at all*, Schlumberger will continue its policy of creating new services and improving the high quality of its present *seventeen* oil field aids.



SCHLUMBERGER

WELL SURVEYING CORP.

HOUSTON, TEXAS

Rio Ule Pipe Line to Deliver First Crude on December 1

Creole Petroleum Corporation has announced that its new pipe line from Rio Ule tank farm to the terminal and refinery site at the Bay of Amuay on Paraguana Peninsula will deliver its first shipmentof oil on December 1. The new line, of 24-26-inch pipe, is designed to deliver about 300,000 barrels a day from the Lake Maracaibo Bolivar coastal fields to a deep-water terminal, thereby releasing a number of shallow-draft lake tankers to take care of increases in production.

In Eastern Venezuela S. A. Petrolera Las Mercedes recently made its first delivery of crude through the new 16-inch 158-mile pipe line from Las Mercedes field in the State of Guarico to Texas Petroleum Company's new terminal at Pamatagual and loaded out the first marine shipment early in July. Subsequent shipments have been relatively small while available tankers are being organized for scheduled loadings. Exclusive of wells completed in the Las Mercedes and Palacio fields during the first half of the year, some 65 wells had been considered productive, but inasmuch as no outlet has existed they will have to be tested under operating conditions before their potential is known. The field has been variously estimated as being capable of producing from 25,000 to 50,000 barrels daily. The new line is capable of moving 60,000 barrels with presently installed equipment.

The Las Mercedes Company has opened a new area southwest of the main portion of the Las Mercedes field and northwest of the smaller Palacio field known as the "43" area since it was brought in by Well No. 43. From early indications it will be somewhat on the order of the Palacio area, fairly restricted as to extent with perhaps 15 or 20 locations to be drilled.

Atlantic & Pantepec's Tucupido field is expected to be connected into the Las Mercedes line with completion of additional oil wells, since it is situated only a few miles from the route of the line. To date two oil wells have been completed at Tucupido and one rig is active in development work.

Richmond Exploration Company near the end of May signed a contract with the Government of Venezuela under the terms of which it must build a refinery inside Venezuela to process at least a portion of the crude oil produced by the company. The refinery is to be built within five years from the time the production of the company reaches as much as 50,000 barrels a day, and is to have a capacity of 25,000 barrels a day when turning out unfinished products, or 10,000 barrels daily of finished products. The agreement scales down the required capacity in accordance with the possibility of smaller production, so that if the company has not developed production amounting to as much as 35,000 barrels, then the refinery can be built so as to handle an amount equal to 10 percent of the production if turning out finished products, or 25 percent if output is unfinished products.

Richmond should enter the producing list with completion of a pipe line from one of its new areas discovered on the great block west of Lake Maracaibo. While it is not known just what production might be expected from present discoveries, at least one well has found Cretaceous production on the west side of the block, while oil has been found in small quantities in the first wildcat drilled on the extreme east, near the shore of the lake. The Zulia Block went into the exploitation period in May of this year.

Results of Exploratory Work In England Prove Disappointing

Although continuing work on the geophysical program, the results of exploratory work by the D'Arcy Exploration Company in England have been rather disappointing in recent months. The company, a subsidiary of Anglo-Iranian Oil Company which opened the Eakring and Formby areas during the progress of World War II, has carried on rather extensive wildcat drilling activity without encouraging success.

In Hampshire the Portsdown 2 well has been completed at a depth of 2871 feet and contrary to seismic interpretation turned out to be structurally lower than the Portsdown 1 drilled in 1937. The Purbeck and Portland Jurassic beds were unproductive although some of the cores taken in the Portland had a slight odor of oil.

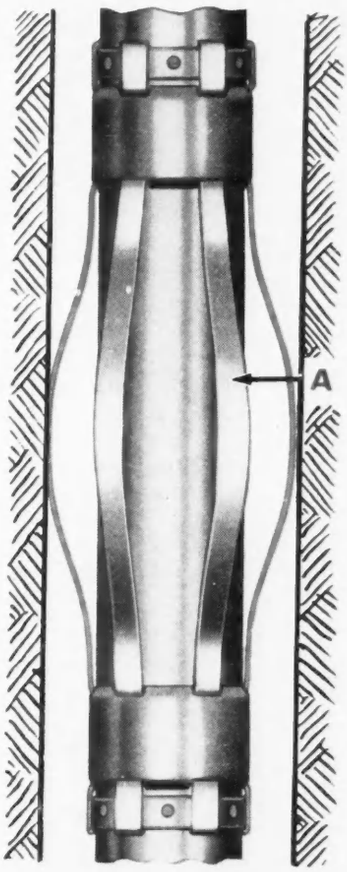
A wildcat drilled at Stoke-on-Tern in the Market Drayton area of Staffordshire has been drilled to a depth of 1832 feet where it was abandoned while still in the carboniferous limestone, and the Eagle Moor 1 wildcat west of Lincoln has also been completed as a dry hole in the Carboniferous limestone at a depth of 3418 feet. This well was situated on an anticlinal nose located by seismograph work and showed some bitumen impregnations in the basal Kueper sandstones. A test drilled on a geophysical high near Wysall, south of Nottingham, reached a depth of 1453 feet in the carboniferous Millstone Grit without showing any oil or gas.

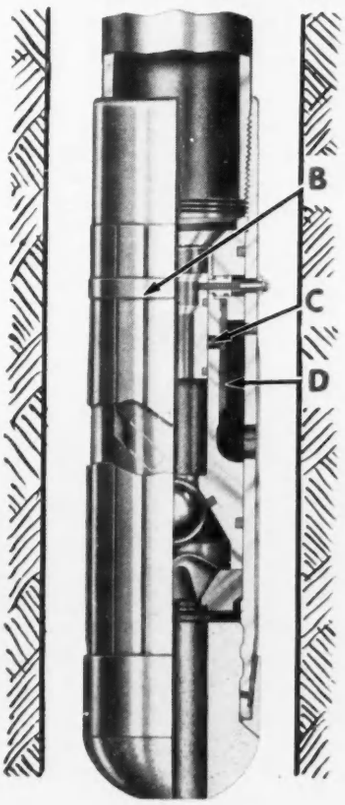
Royal City Gas & Oil Company To Drill Wildcat on Lulu Island

The Royal City Gas & Oil Company, Ltd., has announced that contract has been let for a wildcat well to be drilled on Lulu Island near Vancouver, British Columbia. The new location will be near the site of a well started by the same company, which was abandoned when it started having trouble with surface caveins. Drilling contract has been let to B. J. Henning Drilling Company of Lloydminster.

FOREIGN VISITORS—Foreign guests at the September meeting of the Houston Nomads were, front row, left to right, Kraus Earhart, The Texas Company, Houston; S. Priolli, Jr., Cia Itatig, Brazil; H. Pallares, Ecuadorean consul, Houston; Orlando Priolli, Cia Itatig, Rio de Janeiro; A. J. Pounds, Apex, Trinidad Oilfields; and R. S. Schols, B.P.M., Holland. Second row, left to right, are Delbert Lewis, Foreign Exploration Company, Venezuela; Glenn Byers, Shell Oil, Houston; L. H. J. Hersch, Caribbean Petroleum Company, Venezuela; H. Swolfs, B.P.M., Holland; and H. R. George, Shell Oil, England.

"Triplex" BECAUSE...





A Baker Casing Centralizers (Product No. 910) are installed on, and above, the shoe joint to center the casing and provide a uniform annulus to receive the cement slurry.

B A hold-down strap (secured by shear screws) retains the Baker Metal Petal Basket close against the shoe or collar while running-in the casing and conditioning the hole.

C Cementing ports are covered by the Tripping Valve until cementing is commenced.

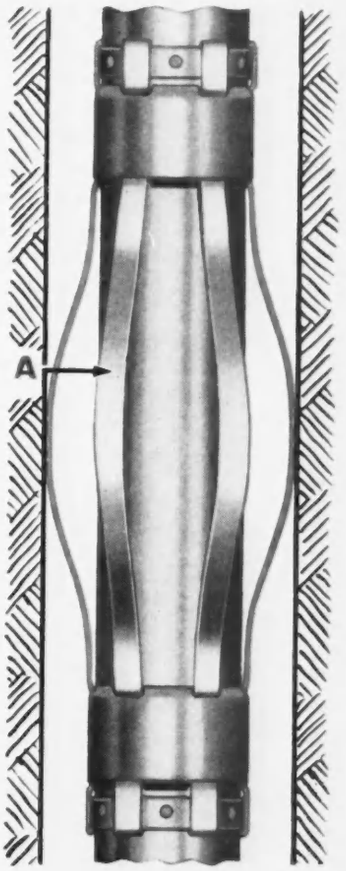
D A fabric-reinforced, resilient rubber, sleeve-type, back-pressure valve opens readily (see dotted white line) to permit passage of the cement slurry into the annulus above, but closes instantly to prevent any return flow of the slurry.

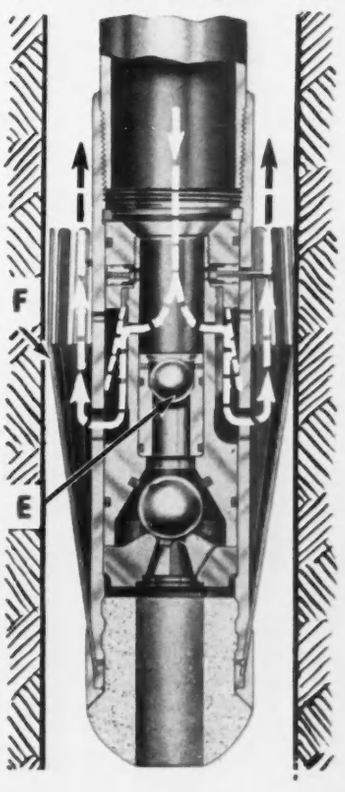
E After reaching the desired point in the hole, circulation is established through the ample central passageway. A Tripping Ball now is pumped (or allowed to gravitate) down the hole to seat upon the Tripping Valve. Pressure of 400 to 500 psi is applied to the casing, which shears the Tripping Valve shear screws and forces the Tripping Valve downward to expose the cementing ports.

F Shearing the screws also releases the Basket hold-down strap and allows the Metal Petal Basket to expand outwardly against the wall of the hole. The Basket with which each Triplex Shoe is equipped has a wide range of expansion and forms a bridge in large-diameter, or irregular-shaped holes far beyond the range of a rubber packing element.

The cementing operation now is carried out in the conventional manner with the cement slurry directed upward with the exclusive Baker "Whirler" action. This "Whirler" principle has proved to be far superior to an undirected jetting action which does not minimize the hazard of channeling, and may wash out cavities and cause cement contamination.

Only readily drillable materials are used for all internal parts; and two one-half inch set screws hold the inner assembly stationary to facilitate drilling out.





CEMENTING EQUIPMENT

Egypt's Production in 1948 May Exceed 1947 Output

THE installation of additional facilities for handling production in some of the older fields and the success of the exploratory drilling program indicate that production from Egypt during 1948 should compare favorably with the 1947 output of 8,913,800 barrels.

Speaking at Anglo-Egyptian Oilfields, Ltd.'s annual meeting, Sir Robert Waley Cohen, chairman, said that the company's future depends largely on the success of the active exploratory program even though its current production amounts to more than 9 million barrels a year. He said the discovery of new sources of oil "cannot be achieved without widespread and costly exploration."

In following up this program, the company has made considerable progress during the past year in geological and geophysical work, in part of which it has been joined by Socony-Vacuum Oil Company. The joint project has included a seismic survey started in 1946 and a seismic survey on the Sinai peninsula. A gravity party employing a new technique has started a survey in the Gulf of Suez offshore from the Sinai coast along a trend where several promising showings have been found.

Particularly encouraging is the completion of a second well in the Asl area with an initial production of 600 barrels daily of crude oil comparable to that being produced from the new Sudr field nine miles to the north. The production occurs in formations quite similar to those from which Sudr wells produce. A rig is being kept busy in the Asl area and some better idea of its possible extent should be available before long.

Through the installation of new dehydration and desalting equipment in the Ras Gharib field during the latter part of 1947, it has been possible to obtain greatly increased production from many wells which produced high percentages of water. Heretofore, it has been necessary to restrict the production of such wells to the capacity of the field equipment to extract water and salt. It is thought that the full effect in increased production will be much more evident during 1948, with the result that production may be kept up to at least the 1947 level of 8,847,000 barrels for the year. The record of production through the first half of the year would indicate that this may be exceeded in 1948. It was pointed out that this increase is due only to the availability of more daily production from available reserve and will only result in quicker depletion. What is needed is additional new sources of production.

The Hurghada field, a relatively small contributor to the total output from Egypt, is receiving some attention now in an effort to prove up possible extention areas around that now under exploitation. A drilling rig has been assigned to the area and the success of its first extension attempt has been such as to have it kept busy on continuous outpost drilling. The first well was a definite step-out northwest of the old field and was completed pumping at the rate of 350 barrels a day.

For some time the company has desired to make additions to complete the modernization of its refinery at Suez. This has not been possible because of the congested site. It now seems that the Egyptian government will place more land at the disposal of the company adjoining the present site, and work may be started on additions and replacements before too long.

Recently representatives of the Department of Quarries and Mines of the Egyptian Government stated that production from the new Asl field, in addition to the Sudr discovery of last year, would do much toward making Egypt self-sufficient as to oil products within a matter of two years, and added that Egypt may even become an exporter. The government expects Asl to become a producer on the order of 25,000 barrels daily, about the same as Ras Gharib.

Economy Measures Cause Drop In Spanish Petroleum Imports

Imports of petroleum products into Spain are estimated to have fallen from 6,854,000 barrels in 1946 to 6,700,000 barrels in 1947, as a result of the economy measures introduced in July last year. The totals include about 3,280,000 barrels of motor gasoline in 1946 and 3,180,000 barrels of this product in 1947.

The output of the oil refinery at Santa Cruz de Tenerife rose from 1,390,000 barrels in 1946 to about 1,600,000 barrels in 1947. The CEPSA company has announced plans for an increase of the refining capacity of this plant to more than 5 million barrels per year, though it is doubtful whether all the equipment necessary for the new construction is available.

Declaring Haifa an Open Port Opposed by Israeli Government

A proposal to declare the harbor of Haifa, Palestine, an open port is expected to be submitted to the United Nations as a means of guaranteeing the flow of oil from the Consolidated Refineries, Ltd., there to Middle East and European consumers. Moscow recently broadcast a report that the British, French and U. S. governments had agreed on the plan for the internationalization of the port of Haifa, and an Iraq Petroleum Company official has confirmed that such negotiations have been under way for some time.

The basis for internationalization would be the fact that the output of the Haifa refinery is essential for the carrying on of the scheduled petroleum shipments to European countries under the Marshall Plan. The plan contemplates that by 1952 a total of 52 percent of European oil will be drawn from Middle East sources, as against 38 percent at the present time. Chief objections to the internationalization plan are expected from the Israeli, although the Arabs, too, might protest.

It is reported that a special British-French commission met in London in July and drafted in detail the scheme for the internationalization of the port of Haifa. Zionist leaders have been unwilling to accept the program.

The main spur to the plan is said to come from France. The French Government is a 23.75 percent owner of the Iraq Petroleum Company, and France has depended heavily on crude tenders from the IPC line into Haifa for deliveries to French refineries.

The Haifa refinery and the IPC pipe line from Kirkuk have been closed down for several months because of political disturbances. The Israeli reopened the refinery for a few days, operating it on storage crude, but were forced to shut down again when supplies were exhausted and they were unable to persuade the Iraquis to allow operation of the pipe line from the Iraq fields. It is understood that the Israelis are seeking to conclude a deal for the importation of Roumanian crude to run the plant, and some shipments already have been authorized by Russia.

Both Arabs and Jews fear that if Haifa were made a free port, there would be a danger of the other side receiving the major contribution from the refinery.

All IPC personnel have been transferred from Haifa, and company officials late in September saw little possibility that either the pipe line or the Haifa plant could resume operations in the foreseeable future, unless United Nations action is forthcoming.

NEW AND IMPROVED *Equipment* SUPPLEMENTING COMPOSITE CATALOG

New and improved equipment of manufacturers who describe their products or services in the current Composite Catalog

155—Jet Cutter

This item supplements McCullough Tool Company's data as shown on pages 2557-2584 of Composite Catalog.

A jet cutter, designated the SM 1070, runs on a wire line and is said to be capable of reducing to a few minutes a casing cutting job that normally takes several hours.

Besides the saving in time, this new device eliminates the necessity of running in and out with tubing or drillpipe and the need of rotary machines and mechanical cutters. Damage to tools and the chance of accidents are also eliminated.

For additional information, write McCullough Tool Company, 5820 S. Alameda Street, Los Angeles 11, Calif., *referring to* World Oil *item* 155.

156—Drawworks

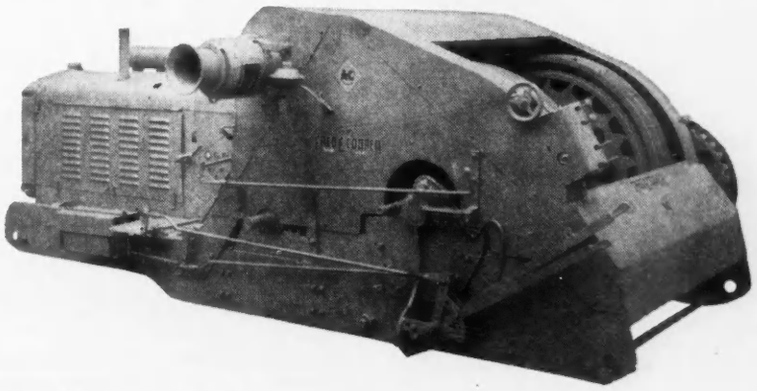
This item supplements Fred E. Cooper's data as shown on pages 201-206 of Composite Catalog.

A single drum self-powered and unitized drawworks has been designed for drilling 4000 to 6000 foot holes and handling work-over jobs to 10,000 feet.

The unit features air controls with finger tip convenience. The clutches are positive dental type, air actuated, and all moving parts are Timken bearing mounted. The drum drives are so arranged that no chain is idling during any operation. Drums are free rolling with eight pulling speeds.

The drawworks is available with rotary drive, catheads, cross-arm spudder, mast, and two or three drums.

For additional information, write Fred E. Cooper, Inc., P. O. Box 1890, Tulsa 1, *referring to* World Oil *item* 156.

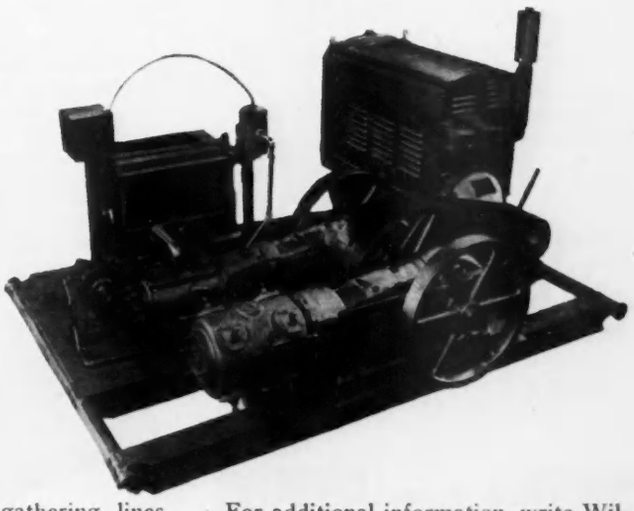


157—Compressor Plant

This item supplements Wilson Supply Company's data as shown on pages 4377-4382 of Composite Catalog.

The packaged portable compressor plant is assembled in both single stage and double stage and is available in various sizes to meet specific requirements. It is mounted on heavy skids and is completely assembled, requiring only connecting the suction and discharge lines to be put in operation. It is easily transportable by truck.

The packaged portable compressors take the place of more costly permanent installations and afford a worthwhile saving on gathering lines. They are especially adaptable to gas-oil lift and repressuring projects and gas line booster work.



For additional information, write Wilson Supply Company, P.O. Box 19, Houston 10, *referring to* World Oil *item* 157.

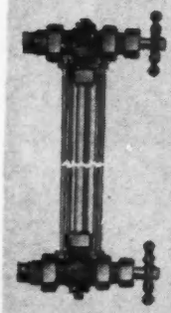
PENBERTHY
Liquid Level GAGES

REFLEX

Reflex type complete with gage valves. Liquid shows black—empty space shows white. Liquid level is always unmistakable.

TRANSPARENT

Transparent type complete with gage valves. Used where through vision is desired under high pressures and/or temperatures.

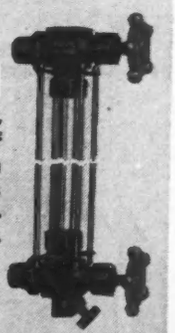


DROP FORGED STEEL

Tubular glass type, Chrome-Moly temperature resisting steel body, stainless steel trim, regrinding removable seats.

ALL IRON

Tubular glass type, extra heavy body of special high strength alloy iron, shanks alloy steel, trim stainless steel, valves self-cleaning.



There is a Penberthy Gage of superior quality for every liquid level gage requirement. Gages are fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. All Penberthy Gages conform with API-ASME requirements.

3277-B

PENBERTHY PRODUCTS

PENBERTHY INJECTOR CO.

Detroit 2, Mich.

Canadian Plant — Windsor, Ontario

NEW EQUIPMENT
SUPPLEMENTING COMPOSITE CATALOG

158—Tubing Elevator

This item supplements J. P. Ratigan, Inc.'s, data as shown on pages 3545-3564 of Composite Catalog.

The Ratigan tubing elevator is a single bail elevator that can be used on either side. It was designed to fill an urgent demand for a faster, easier operating elevator for pulling tubing, especially where gin poles and Blitz rigs are used. It operates just as fast and smooth as a rod elevator.

The locking device is said to be fast and positive and absolutely safe, and can be operated from either the back or front of the elevator. This new elevator has been tested to 200,000 pounds on an Olsen pulling machine without showing any signs of weakness.

It can be furished to take either 2, 2½, or 3-inch tubing.

For further information, write J. P. Ratigan, Inc., 1213 Santa Fe Avenue, Los Angeles 21, *referring to* WORLD OIL *item* 158.

159—Screw Take-Up

This item supplements Dodge Manufacturing Corporation's data as shown on pages 1141-1152 of Composite Catalog.

The Dodge Type H take-up is designed for general conveyor and elevator service. It is rugged in construction, compact in design, and the welded steel frame provides strength and rigidity without excess weight.

The bearings are babbitted, faced on ends and equipped with standard pressure fittings. Load on bearing may be applied in either direction.

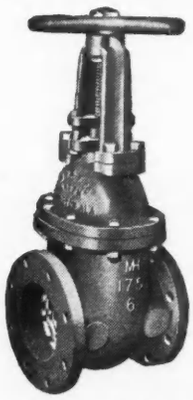
Positive adjustment of the take-up is effected by turning screw heads at either end of the take-up. Adjusting screws are plated and the angle top member protects screw from dust and dirt.

For additional information, write Dodge Manufacturing Corporation, Mishawaka, Ind., *referring to* WORLD OIL *item* 159.

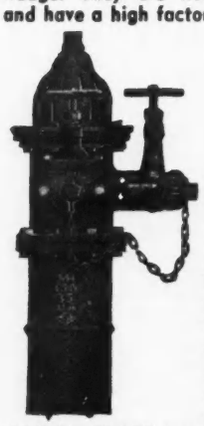
"Red Wheel"

VALVES, HYDRANTS

And Pipe Line Accessories



M & H valves are used in the oil industry for water, gas, steam, oil, chemicals and are furnished in all commercial sizes from 2" to 30", inclusive. They are cast iron body, bronze mounted, furnished double disc parallel seat or solid wedge. They are heavily proportioned and have a high factor of safety.



A. W. W. A. HYDRANTS

Underwriters Approved

Conform to American Water Works Association Specifications. Approved and listed by Underwriters' Laboratories and Associated Factory Mutuals. Well known and widely used for many years.

SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway.

OTHER M & H PRODUCTS

Fire Hydrants	Check Valves
Gate Valves	Floor Stands
Tapping Valves	Extension Stems
Special Castings	Mud Valves
Tapping Sleeves	Flap Valves
	Sludge Shoes

M&H VALVE
AND FITTINGS COMPANY

ANNISTON, ALABAMA

HERE'S A TEAM THAT CAN PULL YOU OUT OF ANY MUD HOLE

In many formations and other conditions influencing mud properties, you'll find a solution to the problem in this "team" of Cyanamid Drilling Mud Compounds:

AEROFLO* Mud Conditioning Compound is efficient in deep wells where high temperatures cause rapid thickening, in salt-cut muds and muds that resist the usual chemical treatments, and in the elimination of sand.

QUADRAFOS* (Sodium Tetraphosphate) simplifies drilling in conglomerate, sand and silty shales where the formation lacks colloidal material. It also helps control strength and gel rate caused by dispersion, heat and salt water, and renders calcium and magnesium effects inactive.

AEROTAN* Water-Loss Control Reagent is a viscous liquid supplied directly to the mud stream. It is completely soluble, requiring no heat for complete solution, and is not adversely affected by high temperatures. Excellent for treatment of cement-contaminated muds and conditions caused by bentonitic and sluffing shales and hard chert. Be sure and investigate the economies of using AEROTAN in place of the conventional types of tannins.

It's liquid

AEROSEAL Q* Mud Conditioning Compound offers an efficient and economical means of regulating mud viscosity, weight and gel strength by sealing the well walls with a thin, tight cake that promotes speed and ease of drilling under a wide variety of conditions.

**Reg. U. S. Pat. Off.*

AEROFLO, QUADRAFOS, AEROTAN and AEROSEAL Q Drilling Mud Compounds are produced under rigid chemical control. For complete information call, write or wire American Cyanamid Company, 229 Shell Building, Houston, Texas, or Los Angeles, California.

When Performance Counts—Call on Cyanamid

DRILLER DAN SAYS:

Are your mud conditions run-down, nervous, irritable? See a Cyanamid Mud Control Doctor before it's too late. He'll gladly prescribe the correct formula for recovery.

†QUADRAFOS and ‡AEROFLO are delivered from stocks kept by many drilling mud chemical distributing houses in all principal oil well drilling centers in the United States.

‡AMERICAN CYANAMID COMPANY
(Manufacturer and Selling Agent)
†RUMFORD CHEMICAL WORKS
(Manufacturer)
†AMERICAN CYANAMID COMPANY
(Selling Agent)

American Cyanamid Company

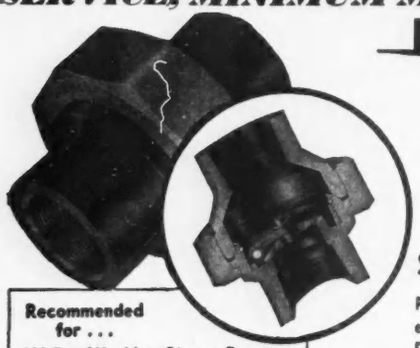
Industrial Chemicals Division

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

GENERAL INDUSTRY
CHEMICAL & PROCESSING
OIL FIELDS
MINING
POWER PLANTS

Wherever piping dependability is a MUST...

CATAWISSA VALVES ARE THE ENGINEER'S PREFERRED CHOICE FOR TROUBLE-FREE SERVICE, MINIMUM MAINTENANCE COSTS!



LOOK AT THE ECONOMY HERE!

Eliminate the usual additional union and nipple on either outlet or inlet end of the line!

Double Extra Heavy Hot Forged Steel SWING CHECK VALVES

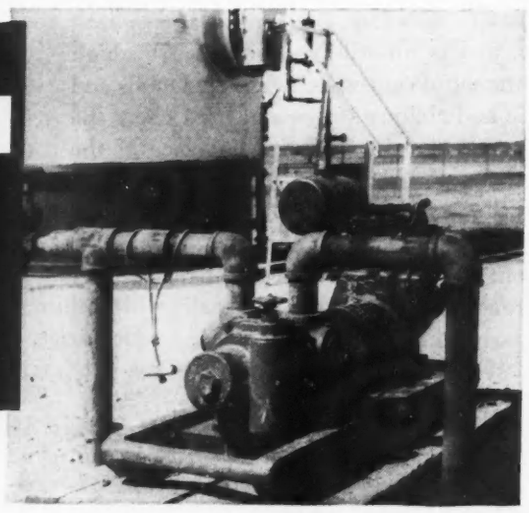
Pipe union type, especially adapted for high temperatures, extreme high pressure service, corrosive and acid conditions. Designed for perfect freedom of movement, with 100% opening. Stainless steel flapper and assembly, forged steel integral seat.

Recommended for ...
600-lbs. Working Steam Pressure
1500-lbs. Oil, Water or Gas
Tested to 4000-lbs. NSHP

DISTRIBUTED BY
OIL WELL SUPPLY COMPANY
BRANCHES SERVING ALL OIL FIELDS
WRITE FOR BULLETIN 10-A
CATAWISSA VALVE & FITTINGS COMPANY CATAWISSA, PENNA.

HOT FORGED STEEL STAINLESS STEEL
UNIONS

This **WISCONSIN** *Air-Cooled* **ENGINE** *Pays for Itself Every 60 Days!*



Down in Andrews County, Texas, you will find this little Model AK 4-cycle single cylinder Wisconsin Air-Cooled Engine giving an exceptionally good account of itself on an oil recycling operation.

It is reported that this unit, consisting of the AK Wisconsin Engine direct-connected to a Yale & Towne pump, pays for itself every 60 days through the oil that is saved.

No matter what the power job happens to be, if it falls within a 2 to 30 hp. range, you will be well-advised to specify and stick to Wisconsin Air-Cooled Engines—built for heavy-duty all-weather service in any climate and delivering MOST HP. HOURS of on-the-job service.

WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
510 Atlas Building, Tulsa, Oklahoma
M & M Building, Houston, Texas
Oil field distributors for Wisconsin Engines and all types of utility units.

NEW EQUIPMENT
SUPPLEMENTING COMPOSITE CATALOG

160—Speed Changers

This item supplements Link-Belt Company's data as shown on pages 2317-2352 of Composite Catalog.

The H-6 unit of the Link-Belt line of P.I.V. Gear variable speed changers is rated 20 horsepower for speed variation rates of 5 to 1 and 6 to 1, and 25 horsepower for speed change ratios of 2 to 1, 3 to 1, and 4 to 1.

It is made only in a plain, basic horizontal assembly, with housing split horizantally. In other words, the housing consists of a top and bottom half, instead of the central housing and side plate construction employed on the smaller gear sizes.

All units are compact, all-metal, fully enclosed, and self-lubricating.

For additional information, write Link-Belt Company, 2045 W. Hunting Park Avenue, Philadelphia 40, *referring to* WORLD OIL *item* 160.

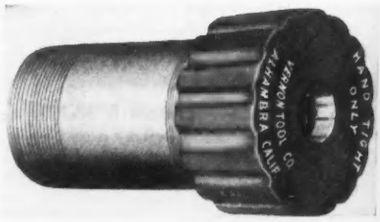
161—Stuffing Box

This item supplements The Vernon Tool Company, Ltd.'s data as shown on pages 4170-4171 of Composite Catalog.

In the Vernon "fluid-sealed" stuffing box, the only metal parts that may contact the polish rod are made of brass which eliminates the danger of scoring the rod and indefinitely prolongs the life of the packing element.

The stuffing box packs off firmly around rod through action of fluid pressure within a specially moulded packing element. Torque-free ball bearing raced cap must only be taken up hand tight for effective pack off. The heavy walled steel body has standard 8V thread to fit conventional well head.

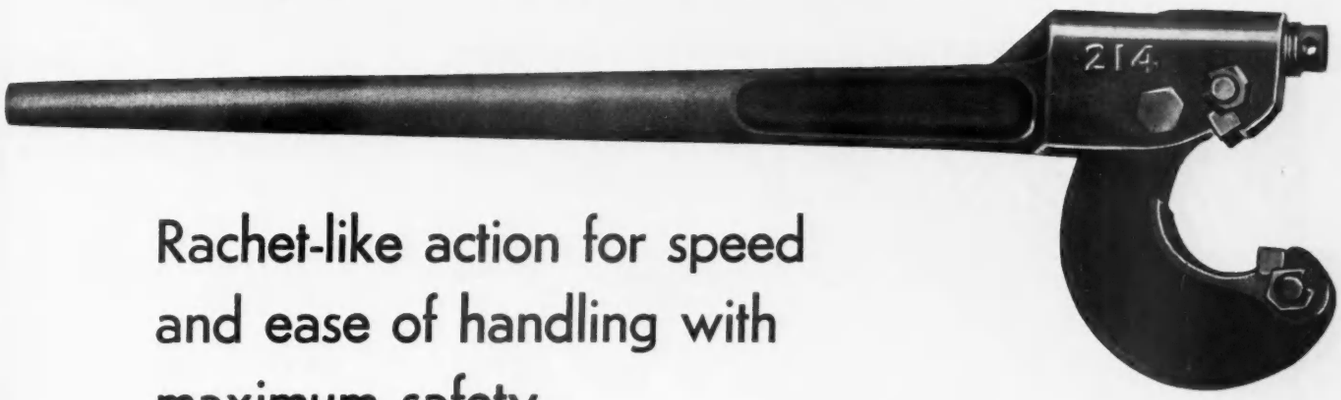
For additional information, write Vernon Tool Co., Ltd., 1101 Meridian Avenue, Alhambra, Calif., *referring to* WORLD OIL *item* 161.



QUICK ACTING

. . . WITH A POSITIVE *"SURE GRIP"*

RATIGAN NO. 214 TUBING TONG



Rachet-like action for speed and ease of handling with maximum safety

The Ratigan No. 214 Tubing Tong is perfectly balanced for fast, efficient work . . . helps to *speed up* the job of running tubing. It is strong and always in position to be put on the tubing. There is no latching or unlatching of any hinged members. The dies are held at the proper angle for taking a positive "sure-grip" instantly. The No. 214 provides a rachet-like action for speed and ease of handling with the ultimate in safety.

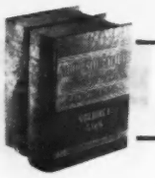
The Ratigan No. 214 Tubing Tong is new in design and much lighter in weight than previous Ratigan Tongs, yet has greater strength. It incorporates an exceptionally fast, easy method of changing dies . . . change a set in less than one minute. They simply slip into place and are held firmly in position by a lock nut. It will take three sizes of jaws—2", 2½" and 3"—which can be changed easily and quickly by means of our quick-acting, automatic locking pins.

All Ratigan Products Are Illustrated and Described In The 1947-48 Composite Catalog, or write direct to:

J. P. RATIGAN, Inc.

1213 Santa Fe Avenue **Los Angeles 21, California**

Ratigan Products Are Sold Through Leading Supply Stores



NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

162—Rotating Scratchers

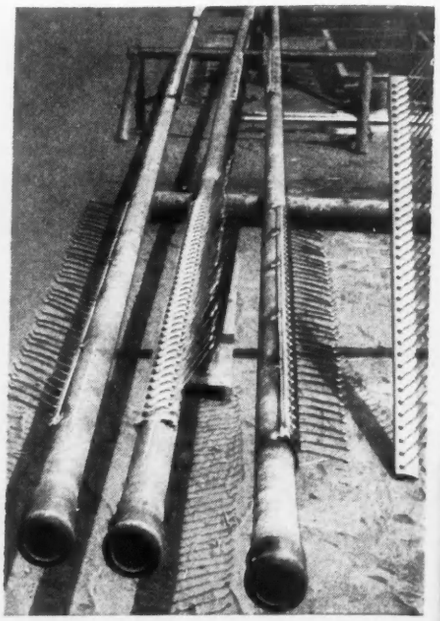
This item supplements B & W Inc.'s data as shown on pages 562-565 of Composite Catalog.

B & W Rotating Scratchers are designed to improve the cementing or completion operation by removing the mud cake from the formation face just as the cement is placed, with the result that the cement is well set and closely bonded to the clean formation.

A series of strong, multiple-strand spring steel wire units are mounted on 5-foot base strips. These strips are spot-welded to the casing or tubing throughout the section or sections of the hole where a complete cement seal is necessary.

In operation, the pipe equipped with rotating scratchers is run to cementing depth and rotated while the cement is pumped into space. The mud cake removed from the formation face is displaced ahead of the rising cement.

For additional information, write B & W Incorporated, Long Beach, Calif., *referring to* WORLD OIL *item* 162.



Added to the ever-growing lists of Christensen "firsts" for the oil-drilling industry is the Christensen Face Discharge Bit This bit was developed in an attempt to obtain greater core recovery for a major oil company in the Oklahoma field. Its technical characteristics are based on previous Christensen experience in the mining field. In some formations, Christensen Face Discharge Bits have increased core recovery as much as 30%!

The Christensen Face Discharge Bit reduces jetting and washing action around the core. It is particularly effective in soft, broken or loosely-cemented formations.

Complete information is available on request.

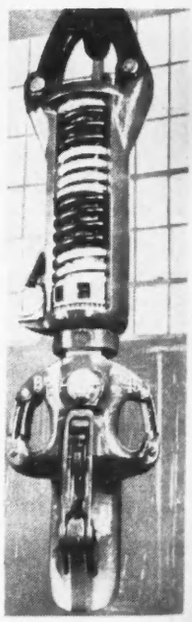
LESS COST PER FOOT
CHRISTENSEN DIAMOND PRODUCTS

CHRISTENSEN DIAMOND PRODUCTS CO.

1975 SOUTH SECOND WEST SALT LAKE CITY, UTAH TELEPHONE 6-8738

163—Triplex Hook

This item supplements Byron Jackson Company's data as shown on pages 797-896 of Composite Catalog.



A super-triplex hook has double spring construction and solid one-piece shank with no load-carrying threads. These hooks are available in four capacities . . . 60-ton, 125-ton, 200-ton, and 300-ton. Precision-machined swivel rings (lower one visible in the picture) carry loads evenly and permit free rotation when the hook is unlocked. The shank has no load-carrying threads. A sub-shank threads into the lower section of the shank. The sub-shank carries only the compression of the low-stressed relief springs.

The super triplex line of books feature six to eight inches of spring travel. This assures soft easy action and eliminates the need for exact spotting of the travelling block.

For additional information, write Byron Jackson Company, Oil Tool Division, Box 2017 Terminal Annex, Los Angeles 54, *referring to* WORLD OIL *item 163.*

Illustrated is the UNIBOLT Flow Manifold for 10,000 lbs. working pressure (15,000 lbs. test). These manifolds are available in either corrosion-resistant alloy or in regular forged steel; 3,000, 6,000 and 10,000 lbs. w.p.

A WORLD OF CONTROL

(With A Fence Around It)

UNIBOLT *Flow Manifold*

The UNIBOLT Flow Manifold was designed to eliminate much of the bulk and weight of conventional flanged Christmas trees, yet, because of the patented UNIBOLT design, this manifold actually provides a higher factor of safety than the heavier flanged manifolds.

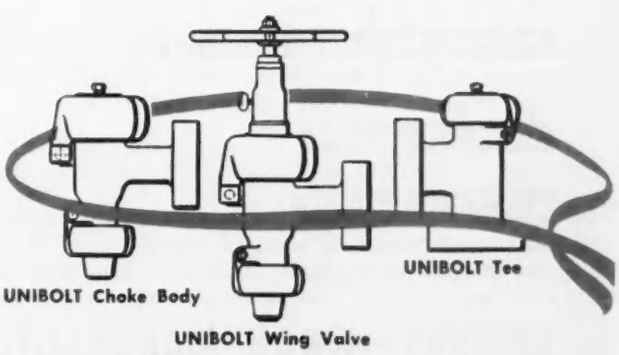
The use of a UNIBOLT Adjustable Wing Valve instead of an ordinary gate or plug valve on the wing is an innovation that has met with the approval of numerous operators, due to the fact that it provides a dependable and easy operable wing valve, requires no grease to effect a seal, costs substantially less, and can be completely overhauled without removal from the well.

Another important advantage of the UNIBOLT Flow Manifold is its complete interchangeability. All connections in the manifold are standard forged steel UNIBOLT Couplings, and any unit in the assembly, or part thereof, may be easily and quickly replaced in the field without removing the manifold from the well.

See your Composite Catalog for complete details, or write direct for literature.

THORNHILL-CRAVER COMPANY

HOUSTON, TEXAS



THREE DISTINCTIVE UNIBOLT FITTINGS Tied Together In A Strong, Light-Weight, Pre-tested Flow Manifold.

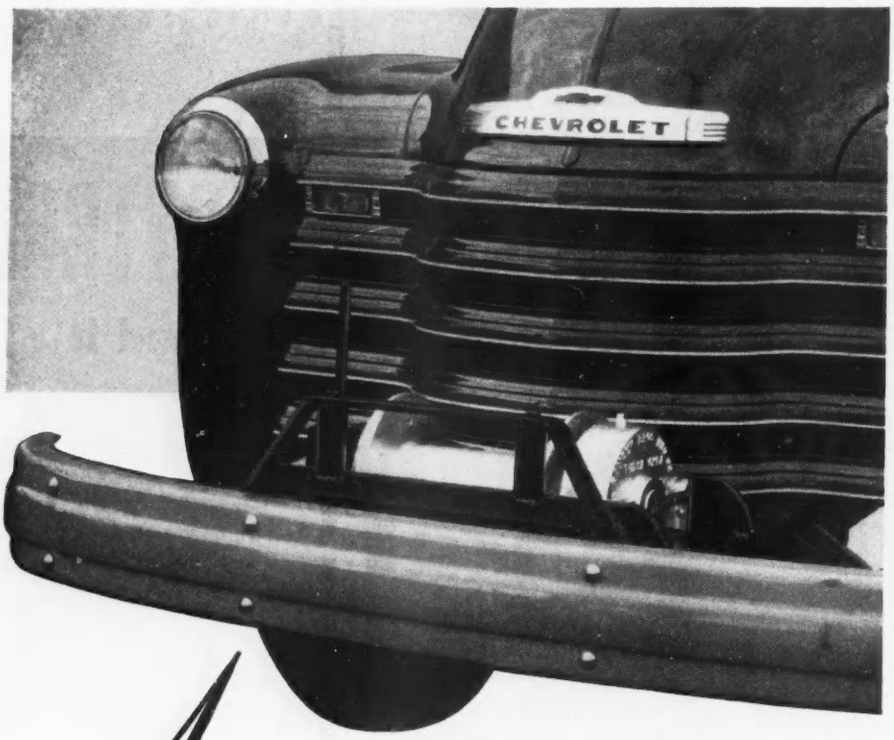
164—Diesel Engine

This item supplements Cummins Engine Company, Inc.'s data as shown on pages 1089-1108 of Composite Catalog.

A diesel engine, based on the Cummins Model H, yet developing 10 percent more horsepower, is designated the HR-600 engine. It develops 165 hopsepower (maximum) at 1800 revolutions per minute with 5⅛-inch bore and 6-inch stroke. Piston displacement is 743 cubic inches. The HR-600 is four-stroke cycle and has the exclusive Cummins fuel system.

Field conversion to HR-600 from H-600 can be made. Steps involved include boring the present block and installing HR-600 pistons and liners and the optional installation of the new increased-flow lubricating system and continuous groove bearings.

For additional information, write Cummins Engine Company, Inc., Columbus, Ind., *referring to* WORLD OIL *item 164.*



Announcing...

THE RAMSEY MODEL 600 FRONT-END WINCH

A truly outstanding Front-end Winch for 1½ to 3-ton trucks that is new and different.

LIGHTER IN WEIGHT Winch without frame weighs only 105 pounds. Light enough for mounting on 1-ton trucks.

HIGHER PULLING CAPACITY Sufficient strength for mounting on 3-ton trucks. Safe working load, 12,000 pounds. Approximate breaking point, 36,000 pounds.

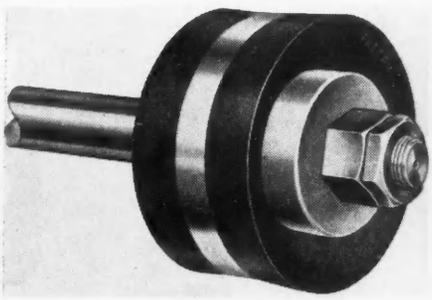
MORE COMPACT Designed for neat front-end mounting with less extension of the overall length of the truck.

EASY TO MOUNT Complete mounting kits available with all parts made to fit certain Ford, Chevrolet, Dodge and International trucks. Anyone capable of installing the power take off can easily install the balance of the winch kit.

RAMSEY WINCH MANUFACTURING CO.
Box 3035 Tulsa, Oklahoma

165—Slush Pump Piston

This item supplements Falcon Products, Inc.'s, data as shown on pages 1269-1276 of Composite Catalog.



The Falcon slush pump piston is designed to move highly abrasive oil or water base muds against heaviest pressures encountered in deep drilling and to permit fast, easy assembly on pump rod.

The rubbers are compounded of special material for use with oil or water base muds and contain no fabric to tear or pull. Rubbers are bonded to a steel center ring. Both hub and follower are made with undercut grooves which, when assembled to the piston rubber element, comprise both a mechanical and pressure seal.

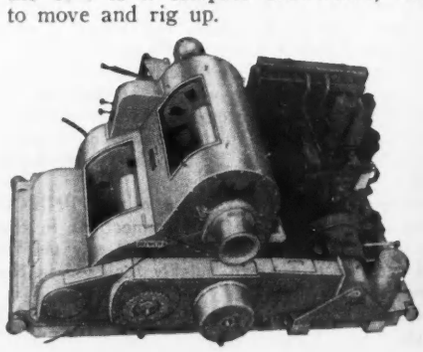
To renew piston, it is unnecessary to remove hub from the taper. Only the rod nuts and follower come off. Worn piston is then slid off hub and replaced with a new piston. This construction makes possible the application of a heavy duty solid type piston without the necessity of breaking rod taper connection.

For additional information, write Falcon Products, Inc., 405 Subway Terminal Building, Los Angeles 13, *referring to* WORLD OIL *item 165.*

166—Rotary Drawworks

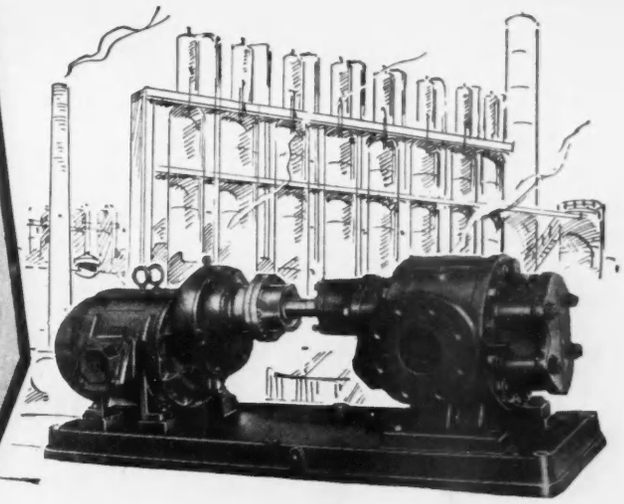
This item supplements The Brewster Company's data as shown on pages 717-748 of Composite Catalog.

An improved rotary drawworks has been designed to give maximum drilling efficiency in medium depth operations. Called the N-4, it is entirely air-controlled. Fawick air clutches and other controls are operated from a central panel at the driller's position. Unitized on a single skid, the N-4 is a compact drawworks, easy to move and rig up.

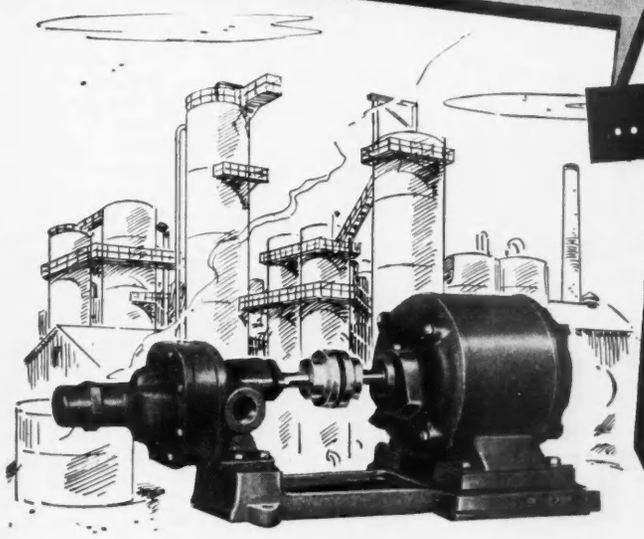


"OLD FAITHFUL"

That's what oil men call the Worthington GR Rotary Pump—a heavy-duty veteran of many years' service in refineries and throughout the petroleum industry. Always ready to do what's expected—and a good bit more—the GR's all-around usefulness is now increased by new inboard bearings and mechanical seals for over-hung drives. Fully described in Bulletin W-487-10B.



Worthington Rotary Pump, Type GR.
Capacities to 5,000 gpm. Pressures to 500 psi.
Available with steam or water jackets.



Worthington Rotary Pump, Type GA.
Capacities to 51 gpm. Pressures to 100 psi.

...AND...

"YOUNG FAITHFUL"

Latest and lightest additions to the Worthington Rotary Pump family, the new GA's are similar in general design and construction to the famous GR's—and equally smooth performers in their class. Bulletin W-484-B31 contains a detailed description.

MEMBER

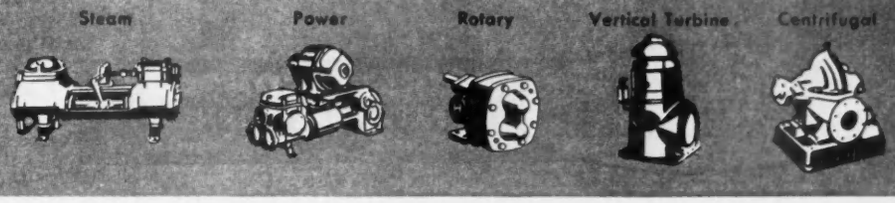
Both the GR and the GA show the advantages of Worthington's long, successful experience in custom-building pumps to refinery requirements. Identical in their outstanding efficiency and economy in many refinery pumping jobs, they join in proving *there's more worth in Worthington.*

Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N. J.

WORTHINGTON

P7-10

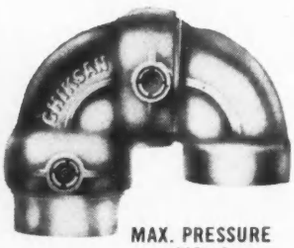
THE WORLD'S LARGEST MANUFACTURER OF PUMPS



COLOR FOR EASIER IDENTIFICATION

You can identify each Type of **Chiksan *Ball-Bearing* Swivel Joint** by its distinctive color. Pressure Ratings are *color-coded* as follows:

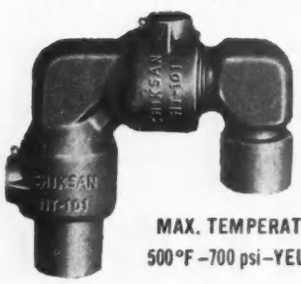
MAXIMUM PRESSURE, 300 psi . . . . . GREEN
MAXIMUM PRESSURE, 1,000 psi . . . . . BLUE
MAXIMUM PRESSURE, 3,000 psi . ALUMINUM
MAXIMUM PRESSURE, 12,000 psi . . . . . RED
MAXIMUM TEMPERATURE, 500° F, 700 psi . . . . . YELLOW



MAX. PRESSURE 300 psi GREEN

MAX. PRESSURE 1,000 psi–BLUE

WRITE FOR THE NEW CHIKSAN CATALOG which gives complete data.



MAX. TEMPERATURE 500°F–700 psi–YELLOW

MAX. PRESSURE 3,000 psi ALUMINUM

REPRESENTATIVES IN PRINCIPAL CITIES

WELL EQUIPMENT MFG. CORP. HOUSTON 1, TEXAS
MID-CONTINENT AREA

CHIKSAN EXPORT CO. BREA, CALIFORNIA • NEW YORK 7
EXCLUSIVE EXPORT REPRESENTATIVE

CHIKSAN TRADE MARK
BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

CHIKSAN COMPANY
BREA, CALIFORNIA
New York 7 Houston 1

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

A torque converter provides fluid cushioned power to handle any load with the ease and flexibility of steam. It automatically supplies top engine power with minimum engine effort and protects the engine from overloads and stall loads.

The hydromatic brake provides smooth, even braking power for greater safety and speed in return trips. It eliminates excessive wear on the conventional brake, and reduces wear of other equipment.

For additional information, write The Brewster Company, Shreveport, La., *referring to* WORLD OIL *item 166.*

167—Bumper Safety Joint

This item supplements Shaffer Tool Works' data as shown on pages 3841-3896 of Composite Catalog.

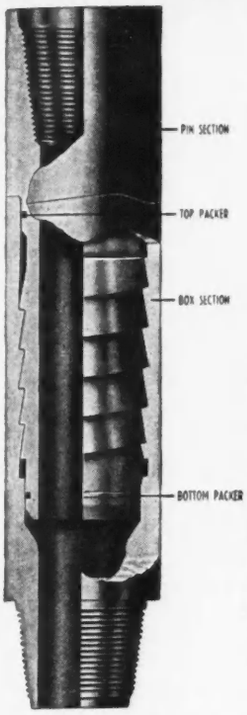
By using a new type of spring arrangement, a bumper safety joint is assembled with a preloaded spring compression that holds it locked in an open position until it is desired to strike a downward blow. To operate the bumper safety joint a weight equivalent to approximately 2000 feet of drill pipe is lowered onto the tool. This weight actuates a foolproof tripping mechanism which automatically releases, allows the weight of the pipe to strike a heavy downward blow, and then automatically re-cocks itself after the blow has been struck. Blows can be struck repeatedly and continually as long as desired by simply raising and lowering the drill string. Also, the weight necessary to trip the tool can be varied, if desired, when assembling the tool.

When drilling with drill collar weight, the tool can be placed immediately above the drill collars to provide maximum protection to the drill string. Should it be desired to apply additional weight during the drilling operations, the weight of as much as 1800 or 1900 feet of drill pipe can be added to the bit without tripping the tool.

In addition to its use as a bumper sub, the tool incorporates a safety joint feature. To operate the safety joint, reverse torque is placed in the drill string and then the required amount of weight to actuate the bumper sub is placed on the tool. The unlocking of the bumper sub, coupled with the reverse torque in the string, rotates the driving lugs into an unlocking slot similar to that of a "J" tool. Then by simply lifting the drill string, the top half of the tool is removed along with the drill string, leaving the lower half in the hole with the drill collars.

For additional information, write Shaffer Tool Works, Brea, Calif., *referring to* WORLD OIL *item 167.*

BOWEN SAFETY JOINT



For

DRILLING—FISHING
FORMATION TESTING
SETTING PACKERS

O. D. and I. D. same as regular tool joints

Will not release or back off any easier than regular tool joints.

Does not interfere with drilling, fishing or testing procedures.

Requires no special tools or attention.

Will release only by deliberate procedure of the operator.

BOWEN CO. of TEXAS, INC.

Office: 2429 Crockett St., P. O. Box 1025, Phone A. 8-4568
HOUSTON 1, TEXAS
Odessa, Texas, Phone 789—Midland, Texas, Phone 1439
Oklahoma City, 6-8087—Houma, La., 6709

The LEADER...for 25 years!

MILLER SAND PUMPS

And Regular Bailers

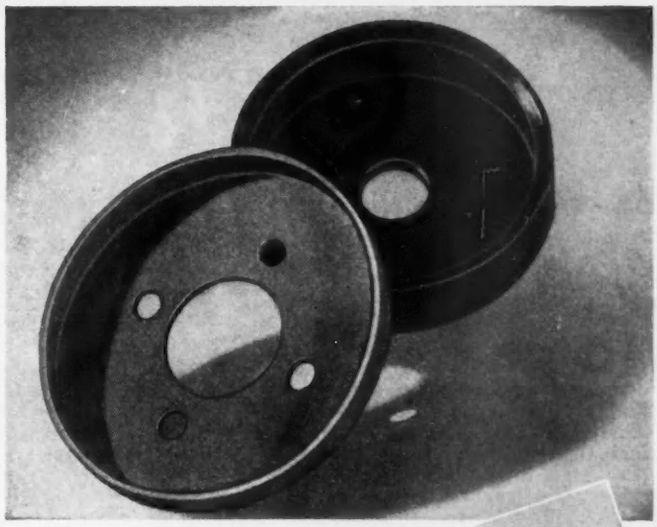
- **Thousands of MILLERS in use Throughout the World!**
- **The Standard Clean-out Tool!**

O. D. Sizes on MILLER SAND PUMPS are: 2½, 3, 3½, 4¼, 5, 5½ and 7 inches. Lengths are 20, 25 and 30 feet. The bail is welded to heavy seamless steel tube. Long heavy grooved plunger assures a liquid seal. Has three interchangeable bottoms. Wire line is direct connected to plunger—gives greater suction. DOES THE JOB! FAST! ECONOMICAL!

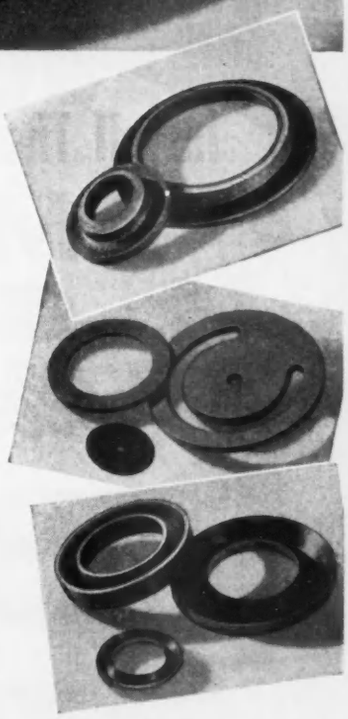
MILLER REGULAR BAILERS are made in 2½, 3, 3½, 4¼, 5, 5½ and 7 inch O.D. sizes and in 20, 25 or 30 foot lengths. Sectional Bailers made to your specifications. See Composite Catalog, page 2666, for prices, parts and details.

MILLER SAND PUMP CO.

1524 SE 29th Street
BOX 4516, OKLAHOMA CITY, OKLAHOMA
Export Office
30 Rockefeller Plaza, New York 20, N. Y.



For Severe Leather Packing Service



Garlock BITAN* Leather Packings are tanned and treated by an exclusive Garlock process for the most severe leather packing applications. They operate satisfactorily at higher temperatures and higher pressures than leathers of standard tannage and treatment.

In filling each order, the leather is properly tanned and treated for the particular service for which the finished product is to be used. All types or forms including: Molded Cups, "U" and "V" Packings, Flange or Hat Packings, Gaskets, Washers, and Discs. All sizes. Write for descriptive folder.

THE GARLOCK PACKING COMPANY
PALMYRA, N. Y.
Tulsa, Okla. Houston, Tex.
Los Angeles, Calif.

*Reg. U. S. Pat. Off.

GARLOCK *Bitan** LEATHER PACKINGS

OTHER NEW AND IMPROVED *Equipment*

168—Hydra-Line Rig

The Mason hydra-line rig combines the simplicity and smoothness of hydraulic power with the utility and flexibility of wire rope to completely eliminate drawworks and traveling block assemblies. Raising and lowering are accomplished by simple manipulation of a single micro-sensitive control.

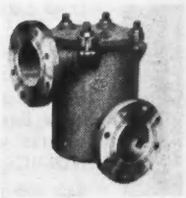
The hydra-line consists of only five principal parts: a smooth-bore steel cylinder, sealed top and bottom and with one common input-output port; a piston and telescoping tube assembly; a wire line passing through the telescoping tubes and secured to the piston; and a large diameter crown sheave positioned to carry the wire line from the piston to load being raised or lowered.

Fluid introduced in the cylinder above the piston forces the piston downward to lift load suspended from wire line, fluid bled from the cylinder plus air pressure compressed during piston down-travel forces the piston upward to lower the load.

For further information, write Hydra-Line Division, Johnston Enterprises, 3035 Andrita Street, Los Angeles, *referring to* WORLD OIL *item 168.*

169—Offset Strainer

An offset sinlex strainer has been developed to permit the strainer to be completely drained as the line itself is drained. With the inlet and outlet at right angles, the unit can be installed to form a right angle connection in a piping system.



The basket and basket chamber can be made to any length, depending upon the amount of entrainment in the stream. Cover is removable for lifting out the perforated strainer basket. Cleanout plug is furnished to permit steam blowdown cleaning when practical. It is made in cast bronze, steel, semi-steel, iron, or alloyed metals for corrosion resistance.

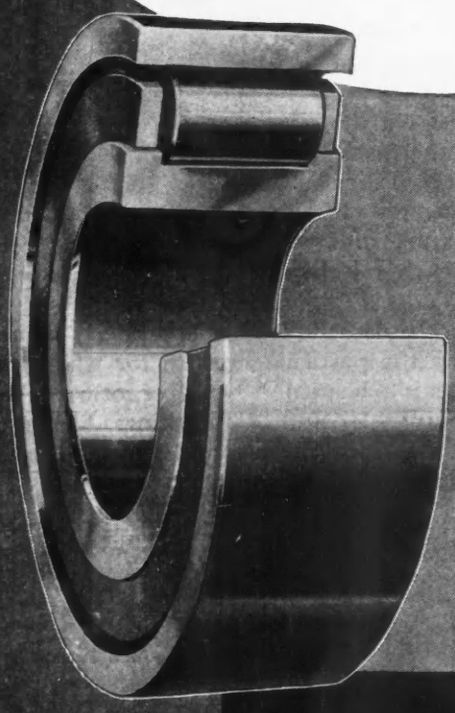
For additional information, write J. A. Zurn Manufacturing Company, Erie, Pa., *referring to* WORLD OIL *item 169.*

Install Them and Forget Them!

AMERICAN

RADIAL

Roller Bearings



AMERICAN RADIAL ROLLER BEARINGS are engineered to exacting standards that result in better performance and minimum maintenance.

Furnished in 5 styles, 6 S.A.E. series and 85 sizes. Special designs also available. Write.

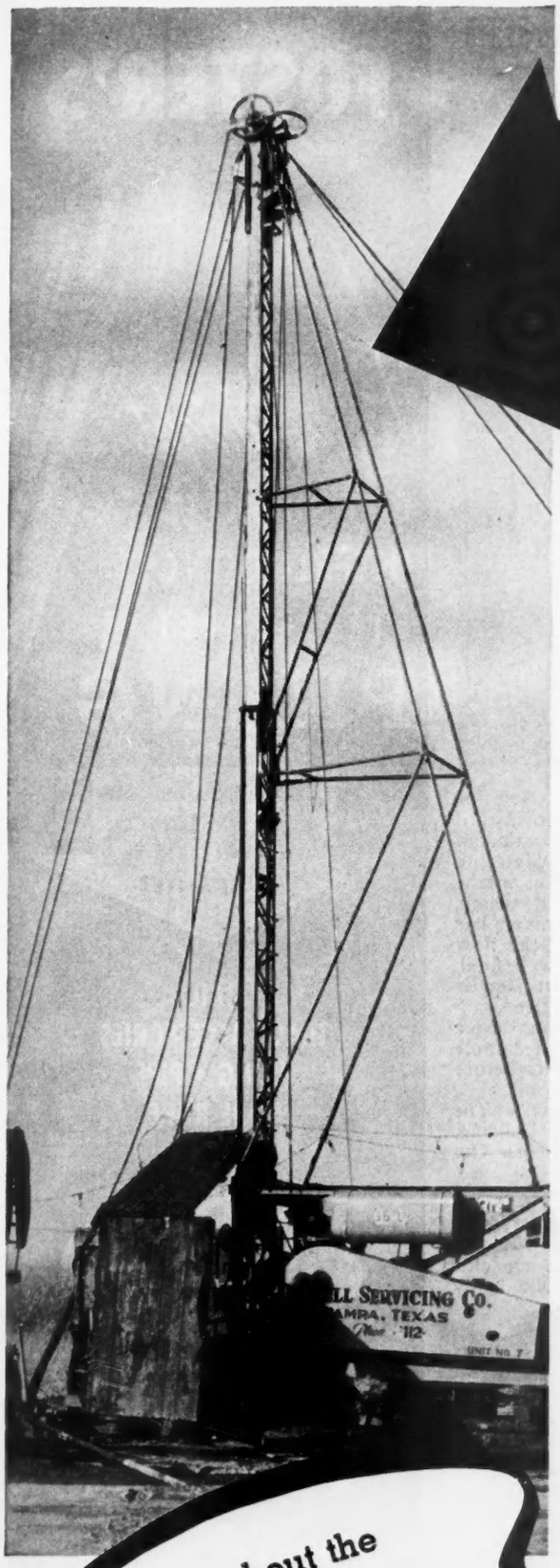
AMERICAN ROLLER BEARINGS HEAVY DUTY

AMERICAN ROLLER BEARING CO.

420 Melwood Street Pittsburgh, Pa.

Pacific Coast Office:

1718 S. Flower St., Los Angeles, Calif.



LESS SETUP TIME MEANS MORE WORKING TIME

WITH BUCYRUS-ERIE SPUDDERS

Within a short time after you arrive on the job with a Bucyrus-Erie spudder, you can be all set up and putting down hole! Speedy Bucyrus-Erie set-ups cut down to absolute minimum the time used in setting up — enable you to spend *more* time actually working on the well. While other units are still being assembled, your Bucyrus-Erie is already producing!

Bucyrus-Erie time-saving features for rigging up include: quick telescoping power-raised and extended derricks; compact folding tubular braces that glide smoothly into place, requiring only to be bolted into position; efficient arrangement of auxiliary casing tackle strut, which does not have to be disengaged while the derrick is being lowered. These are among important reasons why two men are able to rig up a Bucyrus-Erie in a few hours. They are also factors that make teardowns exceptionally fast — giving you a head start on your next job.

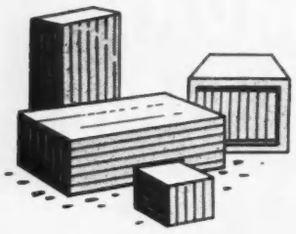
That's why, in a Bucyrus-Erie, you have a big capacity spudder that starts each job off on the right foot. You spend less time getting ready, more time working steady. Such ability to cut corners and costs, plus the drilling speed for which Bucyrus-Eries are noted, pays off in profit for you through time and footage gained. 33547

Ask about the 48-L, 36-L, 28-L, and 24-L machines!

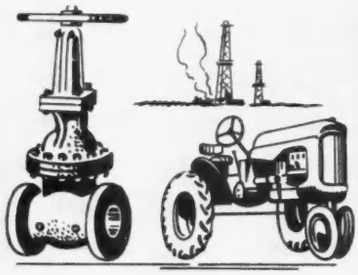
BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

ANY TYPE CRATE



FOR ANY KIND OF PRODUCT



TO GO ANYWHERE

No matter what your product is, HECCO will make a crate and pack your shipment so that it will reach its destination in perfect condition. HECCO'S professional export crating service is available at a surprisingly low cost because of streamlined operation made possible by experienced personnel, modern equipment and proper plant location.

W 3-4610 W. 3-4619

HECCO

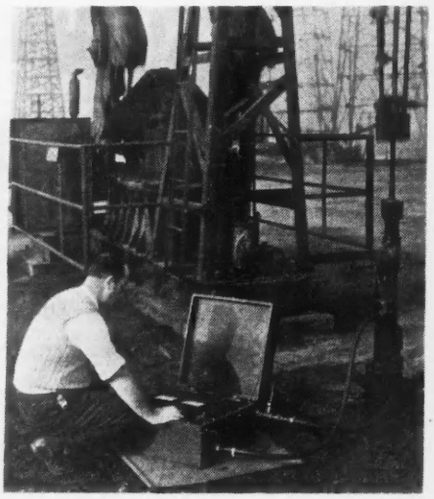
Houston Export Crating Co., Inc.

7400-14 Wingate Houston 11, Texas

OTHER NEW EQUIPMENT

170—Mixing Device

A method for controlling electro-chemical corrosion on tubing, sucker rods, and pump parts in pumping oil wells uses a specially designed mixing device to make a stable emulsion of the oil and brine before it enters the pump.



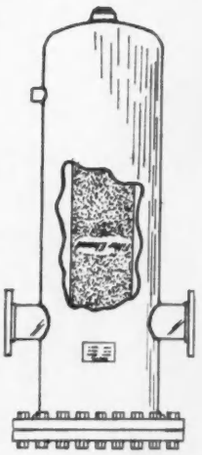
Oil is drawn into the mixer at its lower end and a tail pipe extends downward into the brine, permitting a variation of the oil-brine interface level. Metering orifices in the tail pipe and oil intake maintain a consistent mixture, which, after being emulsified in the mixer, has a high electrical resistance to the flow of currents generated in the well fluid. Thus the electro-chemical corrosion is eliminated or substantially reduced.

The effectiveness of the mixing device is determined at the well head sample cock with electronic instruments before and after the installation.

For additional information, write The Cypher System, Inc., 422 Times Building, Long Beach 2, *referring to* WORLD OIL *item 170.*

171—Gas-Oil Line Clarifier

Fine dust, solids or sludges are efficiently removed from gas or fluids by clarifier installed on gas transmission systems, compressor intakes, crude oil, or gasoline fluid streams.



Due to design of filter element, accumulated solids or sludges are easily removed by periodic blow-down. Filter element can be easily replaced in field.

The clarifier has a distinct advantage over mineral seal scrubbers because it eliminates carry-over of oil vapor into downstream side.

For additional information write Hoil Engineering Corporation, Philtower Building, Tulsa, *referring to* WORLD OIL *item 171.*

FOSTER'S

Light-Weight CORRUGATED INTERLOCKING STEEL-SHEET PILING

SOLD UNDER THE L. B. FOSTER CO. WRITTEN GUARANTEE

RAIL
TRACK ACCESSORIES
PILING • PIPE
WIRE ROPE

SINCE 1902

L. B. FOSTER COMPANY

PITTSBURGH 30 NEW YORK 7
CHICAGO 4 HOUSTON 2
SAN FRANCISCO 4

Five convenient warehouses for prompt delivery

WRITE FOR FOLDER No. F-110-A

SAFETY
ON THE JOB

SERVICE FACILITIES

The Texas Employers' Insurance Association maintains facilities whereby employers of labor in Texas can secure complete and highly specialized Workmen's Compensation Service, including:

- Nineteen district service offices.
- Proved financial responsibility.
- Qualified rating and underwriting "know-how."
- Prompt handling of claims.
- Texas' largest insurance safety engineering organization.
- Insurance at cost to Texas employers.

As a rule, workers are willing and eager to cooperate in an accident prevention program when they are shown (1) how accidents affect their safety and reduce their income, (2) how most accidents are caused by carelessness and can be prevented, and (3) how they can help prevent on-the-job accidents.

The job of teaching workers safety on the job is just one of the services provided industry by the safety engineering department of the Texas Employers' Insurance Association under the Association's broad service program. It's a program that benefits both the employer and the workers. It's a program to save lives and conserve greatly needed manpower.

TEXAS EMPLOYERS INSURANCE ASSOCIATION

Home Office: DALLAS • *District Offices in:* ABILENE • AMARILLO • AUSTIN • BEAUMONT • CORPUS CHRISTI • DALLAS • EL PASO • FORT WORTH GALVESTON • HARLINGEN • HOUSTON • LUBBOCK • MIDLAND • PORT ARTHUR • SAN ANTONIO • SHERMAN • TYLER • WACO • WICHITA FALLS

HOMER R. MITCHELL, *Chairman of the Board* A. F. ALLEN, *President*

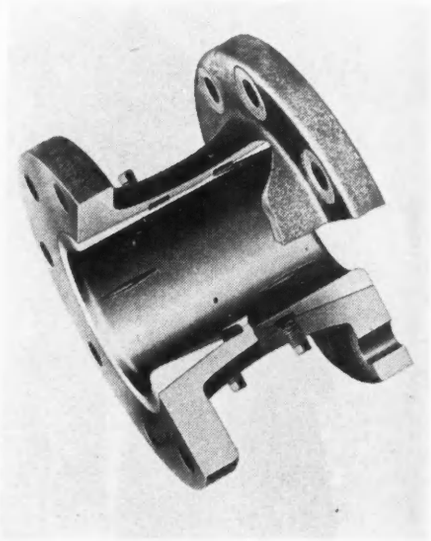
172—Flow Tube

The Beth-Flo Gentile flow tube consists essentially of a short length of pipe equipped with two groups of pressure nozzles around the inner periphery, one group pointing upstream and the other downstream. The nozzle groups are interconnected by common pressure rings from which connections are made to the high and low pressure sides, respectively, of a standard flow meter. The symmetry of this device permits measurement of flow in either direction.

The flow tube is normally less than one pipe diameter in length. It can be installed as any section of a pipe line with no straight run limitations.

Its differential is always a power of the velocity. Therefore, accuracy is constant over the entire range of commercial flow measurement. The flow tube offers a negligible resistance to flow and makes possible large savings in power. It avoids the cost of expensive masonry vaults required for many installations.

Beth-Flo Gentile flow tubes can meter gases and vapors with the same facility as liquids. All readings are taken at the same section of flow path thereby causing the usual connections for internal energy changes to drop out of the flow formula.



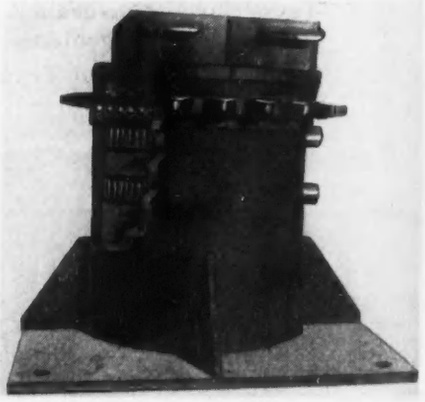
For additional information, write Bethlehem Foundry and Machine Company, Bethlehem, Penn., *referring to* WORLD OIL *item 172.*

173—Rat Hole Digger

The PAMCO rat hole digger has been designed to operate over the rat hole or mouse hole and is driven by 1¼-inch pitch single roller chain from a sprocket tailored to fit the rotary table opening. The sprocket on the machine rests on steel ball bearings and rotates against series of roller bearings to eliminate any friction. Rotary table remains in its digging position and need not be removed from base.

The rat hole digger may be operated at much higher speed than could be obtained on the table were it over the rat hole. Use of the digger eliminates the hazard of moving the heavy rotary table and will cut several hours off the drilling time on each well.

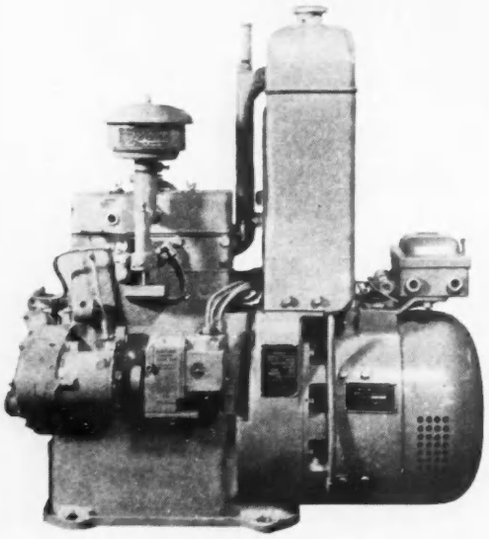
For additional information, write Pampa Machine Company, Box 51, Pampa, Texas, *referring to* WORLD OIL *item 173.*



VALUE NEVER BEFORE OFFERED

BRAND NEW—FACTORY PACKED

KOHLER ELECTRIC PLANTS



MODEL 1M21—1500 WATTS
115 VOLT AC MANUAL CONTROL

AT MORE THAN

50% REDUCTION

☆

OUR SPECIAL PRICE

$275.00

F.O.B. PHILA.

☆

INCLUDING $125.00 WORTH OF OPERATING SPARE PARTS

☆

KOHLER—THE STANDARD IN THE FIELD

☆

AT THIS REMARKABLE PRICE—EVERY FIELD JOB & RIG SHOULD BE EQUIPPED.

SPECIFICATIONS

ENGINE—Four cylinder, four cycle, valve-in-head, bore 2", stroke 3", 1200 R.P.M. 4 H.P. High tension magneto ignition. Enclosed mechanical governor maintains constant voltage and regulates fuel consumption to load. Mechanical fuel pump draws fuel from supply tank.

GENERATOR—1½ KVA, 115 volt AC, single phase, 60 cycle. Built-in exciter and starting motor with large commutator. AC collector rings are a special composition that will not rust, corrode or burn.

LUBRICATION—Pressure pump forces oil to rocker arms, gears and main bearings—splash to cylinders and connecting rods.

COOLING—Water cooled, with efficient radiator and fan.

FUEL SUPPLY—10 gallon tank.

PETER COOPER ASSOCIATES

5600 Ogontz Ave. Philadelphia 41, Pa. WA 4-4242

He works for you

He's a field engineer specializing in wire-rope problems. He works for Bethlehem, but he also works for you.

Let's say you operate machinery that uses wire rope. Maybe you haven't been getting maximum service from your lines and don't even realize it. Maybe they haven't been lasting as long as they should, and it's costing you money, whether you know it or not.

A spot like that is where the Bethlehem man can help. He knows wire rope, all the many sizes and types and grades. He also knows the kind of machines you use—how they work, what they do; why they need a certain lay of rope, a certain type of core.

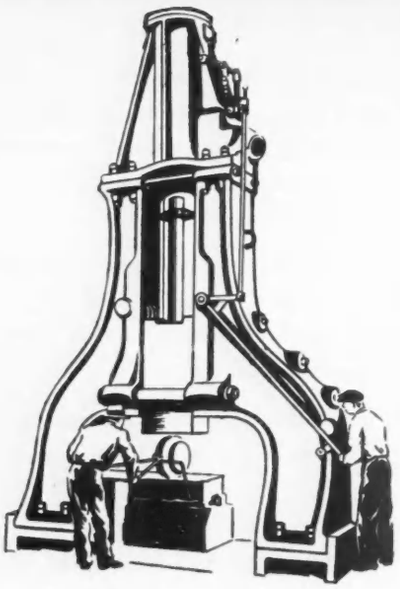
If you'll ask him to study your needs, he'll give you a prompt analysis and recommend the proper ropes. He'll show you ways to get the most out of them. Both are points that have a vital bearing on rope life and efficiency.

No matter where you are, the Bethlehem man is glad to be of service to you. Call him in whenever you need him... doesn't cost you a penny.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

When you think WIRE ROPE ... think BETHLEHEM

STEEL FORGINGS IMPROVE THE QUALITY OF YOUR PRODUCT



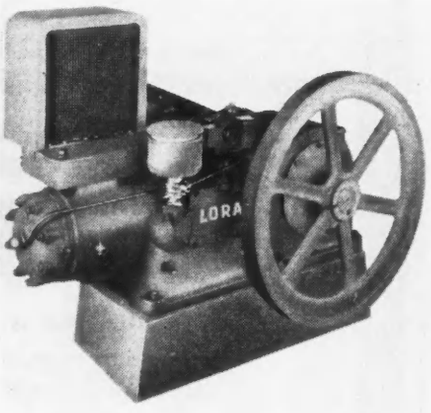
Specializing in rough and semi-finished steel forgings for oil-field equipment manufacturers for many years, we have acquired the facilities and "know how" for producing fine forgings. Complete details on this specialized service will gladly be sent to interested operators on request.

BEAUMONT
WELL WORKS COMPANY
INCORPORATED
BEAUMONT, TEXAS

OTHER NEW EQUIPMENT

174—Two Cycle Engine

A single cylinder, horizontal, two cycle multi-fuel engine, manufactured as a companion power plant to the current Lorain Type "L," is rated at 34.3 horsepower. It has a 9½-inch bore and 10-inch stroke with Timken bearings on crankshaft and crosshaft. Wet-sleeve type cylinder liners are of alloy cast iron, assuring long life and easy replacement on location. This eliminates costly re-boring and shut down time.



The engine may be operated as a cold starting, full Diesel or converted to burn natural gas or butane as fuel. Conversion is easily accomplished in the field. Condenser type cooling system eliminates need for water pump and makeup water is negligible.

For additional information, write White-Roth Machine Corporation, Lorain, Ohio, *referring to* WORLD OIL *item 174.*

175—Pipe Fitting Covers

Pre-formed, factory-made, pipe-fitting covers of Foamglas for both hot and cold fittings are suitable for the petroleum, chemical processing, and allied fields where exact temperature control is required, whether heat is to be retained or excluded.

The pipe-fitting covers are being manufactured in all sizes for Ls, Ts, unions, valves, elbows and flange covers. Being of true glass composition they retain their original insulating efficiency permanently. Foamglas is not affected by humidity, is waterproof, vaporproof, fire retardant and highly resistant to fumes, acids, and many other elements which cause other materials to lose insulating values.

One of the characteristics of Foamglas is its imperviousness to water and water vapor. This property is of importance in the industrial field where gases, fumes and moisture are a menace to the insulating efficiency of the many organic or porous materials. Foamglas has the same thermal conductivity, whether wet or dry, and will maintain its original low rate of heat transfer permanently, regardless of exposure, and without expensive weather proofing or other protective coverings.

For additional information, write Pittsburgh Corning Corporation, Pittsburgh, Penn., *referring to* WORLD OIL *item 175.*

Bell TUBING SWABS

The New Standard for Efficiency and Economy

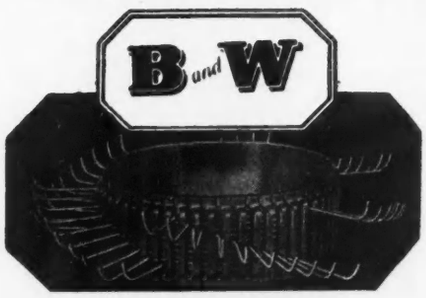
- Lift more fluid each trip.
- Long wearing reversible cups save you money.

2-Cup Swabs for shallow work.

4-Cup Flexible Swabs for deep swabbing.

See Pages 2642-43 Composite Catalog
Patent #2,317,433

MECHANICAL
MANUFACTURING CO., INC.
BOX 1001 PHONE 4-3261
FORT WORTH, TEXAS
EXPORT: BROWN & BECKLEY
30 Rockefeller Plaza, New York



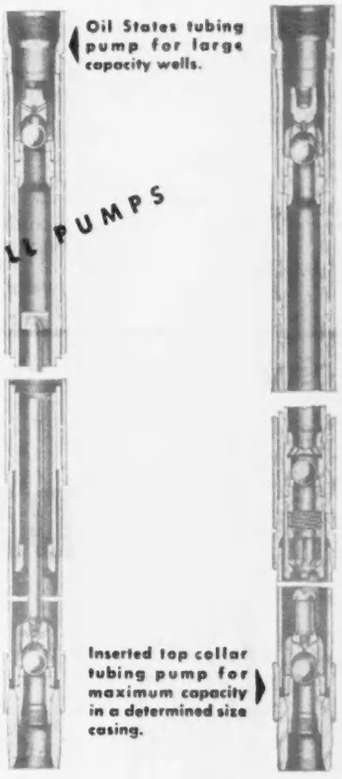
(Patented and Patents Pending)

Enough B & W Wall Cleaning Guides to give you a good cement job cost only 1/10th as much as any squeeze job.

DON'T SQUEEZE!

It Can Be Avoided

BRUCE BARKIS — B-W INCORPORATED — KENNETH WRIGHT
Well Completion Specialists
HOUSTON, TEXAS • LONG BEACH, CALIF.


Oil States tubing pump for large capacity wells.
Inserted top collar tubing pump for maximum capacity in a determined size casing.

PACIFIC • DEEP WELL PUMPS

Certainly your well is different!

Every producer likes to think his well has special problems. It does. But most salesmen don't like to agree. Dresser Industries does agree with you.

More types of pumping equipment, for example, are offered by the member companies of Dresser Industries than any other supplier or group of suppliers. You can get Pacific mechanical lift pumps for any bottom hole condition, or Kobe Free-Type hydraulic pumps or Ideco pumping jacks, each developed for specific needs in specific territories.

Dresser Industries carries this principal throughout the line from well to refinery—service to the industry without an ax to grind for any particular patent. Buy your whole shebang from the Dresser Industries owned companies and you get the type of equipment you need, not just what one of them happens to make.

DRESSER INDUSTRIES, INC.

TERMINAL TOWER • CLEVELAND 13, OHIO

Matched Equipment Matchless Service

BOVAIRD & SEYFANG Mfg. Co.
Bradford, Pa.

BRYANT Heater Company
Cleveland, Ohio; Tyler, Texas

CLARK Bros. Co., Inc.
Olean, New York

DAY & NIGHT Mfg. Co.
Monrovia, Calif.

DRESSER Mfg. Division
Bradford, Pa.

DRESSER Mfg. Company, Limited
Toronto, Ont., Canada

INTERNATIONAL Derrick & Equipment Co.
Beaumont & Dallas, Texas; Torrance, Calif.; Columbus, Marietta & Delaware, Ohio

KOBE, Inc.
Huntington Park, Calif.

PACIFIC Pumps, Inc.
Huntington Park, Calif.

PAYNE Furnace Co.
Beverly Hills, Calif.

ROOTS-CONNERSVILLE Blower Corp.
Connersville, Ind.

SECURITY Engineering Co., Inc.
Whittier, Calif.

STACEY BROS. Gas Construction Company
Cincinnati, Ohio

Stacey-Dresser Engineering Division
Cleveland, Ohio

176—Welding Rod Catalog

The "Page Gas Welding Rods Catalog" is an attractive, three-color, 24-page brochure devoted exclusively to gas welding wire and its use. It covers the complete Page line; gives the application, procedure, proper torch adjustment, physical properties, etc. of each gas welding rod. On the back cover there is a convenient reference chart, "Page Welding Electrodes and Gas Welding Rods." Numerous application photographs are shown.

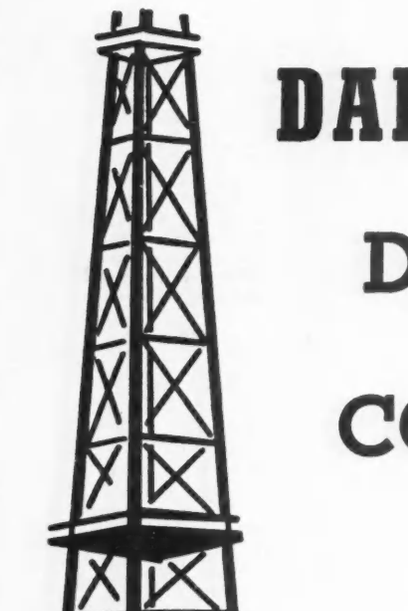
For a copy of this catalog, write Page Steel & Wire Division, American Chain & Cable Company, Inc., Monessen, Penn., *referring to* WORLD OIL *item 176.*

177—Schlumberger Catalog

The Schlumberger catalog presents illustrations and descriptive data on all of the 17 Schlumberger services available.

For a copy of this catalog, write Schlumberger Well Surveying Corporation, Houston, *referring to* WORLD OIL *item 177.*

DAN L. CLARK W. M. AVERILL RUPERT COX



DAN L. CLARK

DRILLING

COMPANY

Drillers of

OIL AND GAS WELLS

POWER AND STEAM RIGS

WILSON BUILDING

CORPUS CHRISTI, TEXAS

Telephones

Local 7746—7747 Long Distance 95

178—Drilling Rig

Bulletin No. 350 describes and illustrates the Ideal type 100 consolidated rig, which is designed for a maximum of 750 horsepower input and for drilling to a nominal depth of 10,000 feet with 4½-inch drill pipe of 12,000 feet with 3½-inch drill pipe. Each unit of the rig is separately illustrated and described. Engineering, operating and lubricating specifications are included, as well as a shaft speed diagram and dimensional drawing.

For a copy of this bulletin, write The National Supply Company, Box 899A, Toledo, Ohio, *referring to* WORLD OIL *item 178.*

179—News Digest

The Visco Digest is a quarterly digest of news and technical articles of particular interest to production and refinery men.

It is intended to serve as a compact reference source on detailed news and technical information appearing in the large volume of trade journals, news magazines, and scientific publications.

For copies of this digest, write Visco Products Company, 6216 W. 66th Place, Chicago, *referring to* WORLD OIL *item 179.*

180—Well Head Equipment

Bulletin No. 313A catalogs National Type B pressure pack well head equipment. Features of construction are described and fully illustrated with cross-sectional views and pictures of individual parts. Special attention is given to seals and packing. Six types of assemblies are shown in half-section and followed by 22 pages tabulating various sizes and part numbers.

For a copy of this bulletin, write The National Supply Company, Box 899A, Toledo, Ohio, *referring to* WORLD OIL *item 180.*

181—Magna-Tector

Application of the Magna-Tector in locating stuck point of drill pipe, casing or tubing is described and illustrated in a four-page, two-color brochure. Benefits to the oil operator are explained and many new uses for the Magna-Tector are listed.

For a copy of this brochure, write McCullough Tool Company, 5820 South Alameda, Los Angeles, *referring to* WORLD OIL *item 181.*

182—Boring Machine

Bulletin describes the Gentry-Mitchell machine for making three-inch to 20-inch diameter bores under highways, railroad tracks and other obstacles where trenching is not permissible or economically advisable. Method of operation is clearly portrayed by diagrams and photographic illustrations.

For a copy of this bulletin, write H. L. Gentry Engineering Company, 921 East Michigan Avenue, Jackson, Mich., *referring to* WORLD OIL *item 182.*

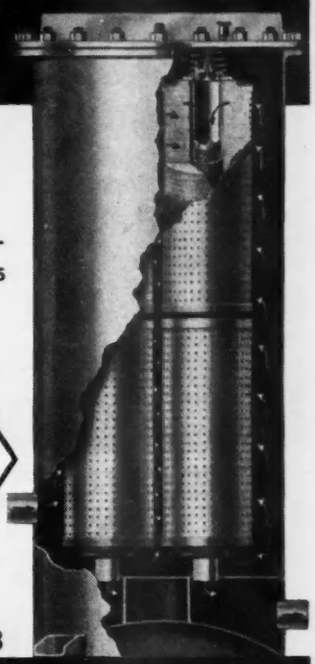
"I'll take the WHITE one every time!"

WYTEFACE "A"
Trade Mark
Steel Tapes for the Oil Industry

WYTEFACE "A" Steel Tapes have raised black graduations on a crack-proof white surface. Easy to read in any light, from any angle. Designed for hard service. Resist rust and corrosion. Raised rims and markings protect the white background from abrasion from rails, pipe, rocks, concrete. Made in styles especially for Oil Riggers, Oil Gaugers and for general measurements. See your supply house, or write for details to Keuffel & Esser Co., Hoboken, New Jersey.

KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
Chicago • Detroit • Los Angeles
St. Louis • San Francisco • Montreal

HILCO HYFLOW OIL FILTERS
For Lubricating and Fuel Oil
Maintenance of Diesel and Gas Engines



- Incorporating the finest features for simplicity and peak performance
- Uses factory packed or repackable filter cartridges
- With or without heaters
- For straight mineral or detergent type oils

All metal Covered Filter Cartridges for SAFETY

Write for FREE literature and recommendations

Model HFC-8

THE HILLIARD CORPORATION
205 W. Fourth St., Elmira, N. Y.

PETROLEUM PRODUCTION

Volume I. The Mechanics of Production: Oil, Condensate Natural Gas

By PARK J. JONES, Consulting Engineer, Houston, Texas

The first of a series of five volumes dealing with the application of the basic engineering principles of drilling oil wells and extracting the oil most efficiently and economically. Presented by a nationally known authority, formerly with The Texas Company, the information is highly practical, and is detailed, specific, and thoroughly documented. The treatment is as clear, concise, and simple as possible, and the explanatory matter is illustrated by extensive use of graphs.

231 pages Illustrated $4.50

Volume II. Optimum Rate of Production

This is the second in a series of five volumes which will comprise the most thoroughgoing treatment of the engineering aspects of petroleum production ever presented. Contents include: The Maximum Efficient Rate of Production; Oil, Condensate and Natural Gas Reserves; Well Producing Capacity for Reservoirs; Interest Factors; The Period of Development; Uniform Rates of Production; Uniform Rates of Depletion; Economic Limits for Wells and Reservoirs; Increasing Rates of Depletion; Decreasing Rates of Depletion; The Optima for Uniform Rates of Depletion; The Optima for Variable Rates of Depletion; Exponential Functions; Natural Logarithms. 295 Pages, $4.50

Volume III. Oil Production by Water

Third volume deals with the application of the basic engineering principles of drilling oil wells and extracting the oil most efficiently and economically.

275 pages Illustrated $5.00

Volume IV. Condensate Production and Cycling

Contents include: Condensation in Reservoirs; Injection into Rich Gas; Injection into Water; Production by Expansion; Displacement and Expansion; Economics of Condensate Production; Radial Reservoirs; Elongated Reservoirs; Linear Reservoirs; Maximum Efficient Rate.

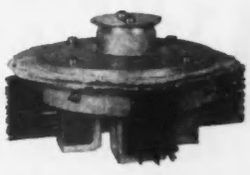
238 Pages Illustrated $5.00

Send orders to
THE GULF PUBLISHING COMPANY
P. O. Box 2608, HOUSTON 1, TEXAS

THE CAVINS DUMP BOTTOM...

is the tool you need for dumping any amount of cement, sand, gravel, acid, or chemical, etc., in a continuous operation without interruption. The full open throat eliminates the hazard of stringing a load through the fluid column. There are no valves, sleeves, or ports to become fouled or clogged—no danger of accidental or premature unloading due to line whip or faulty brakes.

THE CAVINS BRIDGING PLUG



. . . for use in combination with the CEMENT DUMP BOTTOM, is ideal for use in starting an off-bottom bridge or plug. Made of drillable material, can be used for temporary or permanent installations.

24 HOUR SERVICE FROM . . .
THE CAVINS COMPANY
Long Beach: 2853 Cherry Ave., Phone 485-64 • Ventura: 1641 N. Ventura Ave., Phone 6767 • Santa Maria: Phone 1210-L • Bakersfield: 1120 33rd St., Phone 6-6860 • Taft: 204 Center St., Phone 1127

BARRET

SPECIALIZING IN MAGNETIC SURVEYS

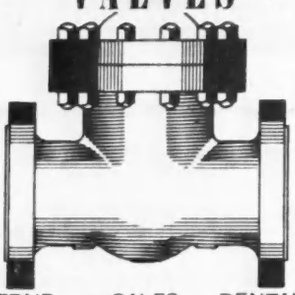
Contracts accepted for domestic and foreign projects, using the most improved instrumental and interpretative technique.

William M. Barret, Inc.

Consulting Geophysicists

GIDDENS-LANE BUILDING
SHREVEPORT, LOUISIANA

RECONDITIONED VALVES



REPAIR — SALES — RENTAL
ALL TYPES OF OIL FIELD VALVES

Odessa Valve & Machine Co.
P. O. BOX 1068 PHONE 3632
PENWELL & T. P. TRACKS, ODESSA, TEXAS

QUICK TURBINE REPAIRS

If you need dependable Turbine repairs *in a hurry*, call us. We are completely equipped to repair and dynamically balance turbine rotors and any High Speed rotating elements in our modern shops.

25 Years Successful Experience

GULF ENGINEERING CO., INC.
"Service, Not Promises"
1499 INGEBORG ST HOUSTON, TEXAS
916 PETERS STREET NEW ORLEANS, LA.

Associations

Program Near Completion for Drilling Contractors' Meet

Registration at 8:30 a.m. Monday, October 11, will open the annual meeting of the American Association of Oilwell Drilling Contractors in the Rice Hotel, Houston. Program for the three-day session is as follows:

Monday Morning

8:30-10: Registration, Rice Hotel Mezzanine.
10: General Session, Crystal Ballroom, Mezzanine, J. E. Brantly, presiding.
1. Address of Welcome
Oscar Holcombe, mayor of Houston.
2. President's address,
E. C. Brown, Brown Drilling Company, Long Beach, Calif.
3. "The Drilling Industry's Current Public Relations Position," Paul Cain, Fred Eldean Organization, Inc., Dallas.

Monday Afternoon

2: Committee Meetings (open to all).
1. Accounting, French Room, Mezzanine.
2. Safety, West South American Room, Mezzanine.
3. Rotary Drilling Equipment and Methods, East South American Room, Mezzanine.
4. Research and Educational, Western Room, Mezzanine.
5. Publications, Headquarters Room, Third Floor.
6. Nominating, Lacquer Room, Mezzanine.
7. Dues, Room E, Mezzanine.
8. Cable Tools, Hunt Room, Mezzanine.

Monday Evening

6: Barbecue, River Oaks Country Club (Courtesy Reed Roller Bit Company).

Tuesday Morning

10: General Session, South American Room, Mezzanine, N. H. Wheless, presiding.
1. "Contractual Liability—What It Means," W. C. Morris, Allen & Morris, San Antonio.
2. Committee Reports.

Tuesday Noon

12:15 Noon Luncheon, Crystal Ballroom, Mezzanine, J. E. Warren presiding.
Guest Speaker: Price Daniel, Attorney General of Texas.

Tuesday Afternoon

2: General Session, South American Room, Mezzanine, A. H. Rowan presiding.
1. "Relation of Drilling Activity to Demand for Crude Oil," Jack Abernathy, Big Chief Drilling Company, Oklahoma City.
2. "The Drilling, Production, and Reserve Situation in the Petroleum Industry Today," Major A. B. Hardey, Independent Producer, Shreveport.
3. "Desert Venture," Movie and Address, E. A. Skinner, Vice President of Trans-Arabian Pipe Line Company, San Francisco.

Tuesday Evening

6: Cocktail Party, Houston Club, (Courtesy Mission Manufacturing Company).

Wednesday Morning

10: General Session, South American Room, Mezzanine, Howard P. Holmes presiding.
1. "An Incentive Plan For Drilling Contractors," Thomas P. Pike, Thomas P. Pike Drilling Company, Los Angeles.
2. "Results Obtained With High Nozzle Fluid Velocity Drag Bits," G. E. Cannon, J. P. Nolley and Douglas Ragland, Humble Oil & Refining Company, Houston.

Wednesday Noon

12:15: Noon Luncheon, Crystal Ballroom Mezzanine, E. C. Brown presiding.
Installation of new officers.

Wednesday Afternoon

2: General Session, South American Room, Mezzanine, Wm. T. Payne presiding.
1. Address by W. C. MacMillan, Vice President, Continental Oil Company, Ponca City, Okla.
2. "Cable Tool Drilling In The Appalachian Area," R. B. Anderson, Columbian Carbon Company, Charleston, W. Va.
3. Resolutions.

Wednesday Evening

6: Fellowship Hour, South American Room, Mezzanine, (Courtesy Hughes Tool Company).
7:30: Banquet, Crystal Ballroom, Mezzanine. Toastmaster, John R. Suman, Vice President, Standard Oil Company of New Jersey.
Address, Colonel T. H. Barton, chairman of the board, Lion Oil Company, El Dorado, Ark.

Geologists and Geophysicists To Hold Joint Meeting in Dallas

A joint regional exploration meeting of the Dallas Geological Society and the Dallas Geophysical Society, local section of the Society of Exploration Geophysicists, will be held November 18-19 in Dallas.

Morning and afternoon technical sessions will be devoted to papers dealing with problems of exploration for petroleum hydrocarbons. A reception and dinner dance will be held Friday, November 19.

McElroy and Moir Appointed To API Lubrication Committee

R. H. McElroy, vice president in charge of marketing for the Pure Oil Company, Chicago, and H. L. Moir, technical adviser to the sales department of the same company, have been named to the Lubrication Committee of API.

PELCO

Welding Saddles

Specify PELCO

IMMEDIATE DELIVERY
OUTLET (OR NOZZLE) SIZES ¼" x 16"
HEADER (OR LINE) SIZES UP TO 36"
Order Through Your Favorite Supply House

PELICAN WELL TOOL & SUPPLY CO.
P. O. Drawer 1108 Shreveport (84), La.

Heavier Slurries Possible

with easy-pumping, hard-setting

UNAFLO

A heavy slurry of Unaflo pumps easily without stiffening during placement, because its delayed, postponed, retarded setting action insures fluidity throughout the entire cementing operation. Even when temperatures and pressures are high, Unaflo allows ample time for unpredictable delays and then sets normally to form a dense seal that is impervious to water and pressures. Protect your well investment—use Unaflo.

Send for further information.

Waco • Kansas City • Birmingham • Chicago • New York

Export Distributors: United States Steel Export Company, New York

WO-U-95

UNIVERSAL ATLAS CEMENT COMPANY

OIL-FIELD CEMENTS

Unaflo *Retarded* Oil-Well Cement
Resistant to Sulfate Waters

Atlas Portland Cement—Type I

Atlas Portland Cement—Type II
Resistant to Sulfate Waters

Atlas High-Early Cement—Type III

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—ABC Network*

NACE Boasts 1400 Members After 4½ Years of Growth

An exceptional growth of a non-profit technical association to meet a specialized need is that of the National Association of Corrosion Engineers (NACE). Started in 1944 by only a dozen pipe line engineers who sought to do something about the enormous loss industry suffers through corrosion, the association in 4½ years has grown to include more than 1400 active members and 190 company members.

The active members include principally engineers working on corrosion problems employed by companies in 32 industries, by various federal, state, and municipal agencies, and by the military services, universities, and engineering consultants. Last April nearly two-thirds of the enrolled members attended the Annual Conference and Exhibit in St. Louis, and each of the 44 papers there presented was heard by an average of 325 members.

The company members include corporations in 18 industries, including many oil and gas companies and petroleum equipment manufacturers. The managements of these corporations are recognizing that the economic losses of corrosion include not only the immediate plant repairs or renewals but also corrosion-caused production or service interruptions, commodity losses or spoilage, curtailed revenues, accidents, fires, personal injuries or deaths, public property damage, customer and public inconvenience, and employee, customer and public ill will.

For dealing with soil corrosion, which directly and indirectly is costing industry about a billion dollars each year, NACE sparks the Correlating Committee on Cathodic Protection which is sponsored officially by it and Association of American Railroads, American Gas Association, American Petroleum Institute, American Public Works Association, American Water Works Association, Edison Electric Institute, International Municipal Signal Association, Inc., United States Independent Telephone Association, Bell Telephone System, and Western Union Telegraph Company. This group seeks through education of managers and engineers to reduce corrosion of buried metal structures, including 988,000 miles of oil, gas and water pipe, 167,000 miles of metal-sheathed communications and power cable, and 425,000 miles of rail track, much of which is protected by signal systems.

For reducing duplication between, and increasing the efficiency of work of various technical societies on corrosion problems, NACE has accepted responsibility for carrying on the functions of the war-born American Coordinating Committee on Corrosion, now called the Inter-society Corrosion Committee. It will have a member from each of a number of societies and associations working on corrosion problems.

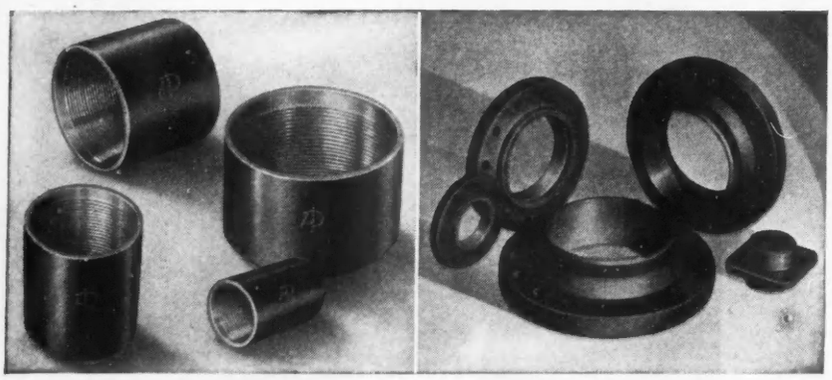
NACE sends monthly to each member a copy of its journal, *Corrosion*, in which is printed important technical articles dealing with corrosion problems of a wide diversity of industry. *Corrosion* also contains many abstracts of other current articles and news on corrosion subjects. As a recent extension of this corrosion abstract service, now covering 85 percent of the world's technical literature, a volume of 1945 corrosion abstracts (including 1200 items) is available, and the 1946 and 1947 volumes are being printed. These are for sale to members at cost and to others at a small profit.

During its earlier growth NACE concentrated on annual and special meetings that were national in scope. Now it is rapidly developing regional organizations and sections to facilitate mutual assistance on a local basis. Present regional headquarters are New York, Chicago, Birmingham, Houston and Los Angeles.

NACE is governed by officers and directors who serve without pay and are elected by the members, and by a small paid office staff headquartered in Southern Standard Building, Houston.

NACE has been campaigning to extend to other industries its memberships on the premise that solving corrosion problems requires the pooling of experience as well as the conduct of research; thus, the more—and more diversified—corrosion experience that can be pooled and disseminated through NACE, the greater and quicker will be the benefits to all who seek to stop corrosion and its economic losses.

HARRISBURG



Oil Field Products

PIPE COUPLINGS

Made to A.P.I. Specifications

Harrisburg Seamless Steel Couplings owe their superiority to almost thirty years experience plus carefully controlled inspection. The accuracy of the threads in a Harrisburg Coupling assures a perfect leak-proof joint. Available in all sizes and types.

PIPE FLANGES

Manufactured to A.S.A. Standards

It is the accuracy of machining that assures the strength and endurance found in all Harrisburg Drop-Forged Steel Pipe Flanges. Threads are perfect in height, angle, taper and gauging. Forged from Harrisburg's own steel and furnished in all types and sizes.

We Make Our Own Steel

Because Harrisburg makes its own steel, complete control of the manufacturing process is assured from open hearth to finished product. Add to this Harrisburg's years of experience in the proper heat treatment of specific products and you have the answer to Harrisurg's superiority in the field.

Send for Complete Catalogs

HARRISBURG STEEL CORPORATION
HARRISBURG, PENNSYLVANIA

You KNOW WHEN THE VALVE IS CLOSED

WHEN YOU USE THE LAYNE "SIGNAL CLOSING" SET SHOE

This Signal Closing Shoe works in conjunction with the "TS" Packer and signals the operator when the valve is definitely closed.

It has a brass Back Pressure Valve and a brass Screw Down Valve made of special alloy, with a tensile strength of 75000 pounds per square inch, but is easily milled out.

The Screw Down Unit has tapered acme thread on inside to receive the tapered Letting-In Tool, and has straight acme threads on outside for closing. If pump is run slowly while the Screw Down Valve is being closed, circulation will stop entirely when Valve is closed. When Letting-In Tool is released from Valve, circulation will start again.

THE LAYNE

TYPE "TS" PACKER

You can make one trip into the hole do the job of two by using the Layne "Tubing Set" Packer. You can save time and expense of coming out with the Setting Tool and it can be used with any type tubing head or christmas tree.

Write for complete catalog

THE LAYNE AND BOWLER COMPANY

EXPORT:
Jeff Tucker
Room 1636
30 Rockefeller Plaza
New York, N. Y.

General Office & Factory
8000 Market Street **Houston, Texas**

WEST COAST:
Layne & Bowler Corp.,
900 Santa Fe Ave.,
Los Angeles, Cal.

Thirtieth AGA Convention To Present Gas Resources

An array of the resources of the gas industry will be on view in Atlantic City, N. J., October 4-8, at the thirtieth annual convention of the American Gas Association and the exhibition of the Gas Appliance Manufacturers Association. More than 10,000 members of the gas business are expected to attend, making it the largest AGA convention ever held.

Broad problems of national import will be covered at the three morning general sessions. Opening the formal business program of the convention will be meetings of the natural and manufactured gas departments on Monday morning and afternoon. Operating details and specific new developments will be discussed at sectional meetings on Tuesday, Wednesday and Thursday afternoons.

Assistant Secretary Elected

L. M. Woodward, assistant secretary of the Derby Oil Company, Wichita, Kansas, has been elected assistant secretary of the Northwest Central States Gasoline Tax Administrators.

International Road Federation Appoints Executive Director

J. H. Sembower of Houston has been named executive director of the International Road Federation with headquarters in London.

J. H. Sembower

Sembower, who is on an extended leave of absence from the Shell Oil Company, was formerly regional manager for Shell's personnel and industrial relations department in Houston.

Robert O. Swain, internationally recognized authority on the development of efficient road systems, has been named assistant to Sembower. Swain developed both the highway transport program of the Marshall Plan and the program which led to the lifting of restrictions on truck transport in Western Europe. He has also served as technical adviser in the Philippine Rehabilitation Program and the Greek-Turkish Aid Program.

The International Road Federation is sponsored in this country by the automobile industry and those petroleum and rubber companies which operate both here and abroad. Aim of the federation is the improvement and extension of road systems throughout the world.

Special Trains to API Meeting In Chicago Planned by Santa Fe

Special trains from Tulsa and Houston and extra cars on regular trains leaving California are planned by the Santa Fe railroad to accommodate those attending the API convention at Chicago, November 8-11, according to P. H. Swinney, Houston division passenger agent .

The Tulsa special, equipped with dining car and lounge, will leave at 5 p.m., November 7, and reach Chicago at 8 a.m., November 8. The return trip will begin at 6 p.m., November 11, with arrival in Tulsa scheduled for 8 a.m., November 12.

The Houston train will leave at 3 p.m., November 6, and arrive at the same hour the following day. Returning, the train will leave Dearborn Station at 3 p.m., November 11, arrive in Fort Worth at 9 a.m., leave ten minutes later, and arrive in Houston at 3 p.m.

The trip to Chicago has been arranged to permit attendance at the S.M.U.-A. & M. game in Dallas. Round trip tickets purchased in Houston will be honored over the Burlington Rock Island train leaving Houston at 9 a.m. and arriving in Dallas at 1:05 p.m. After the game, a bus or other transportation may be used to Fort Worth. The special from Houston will reach Fort Worth at 8:50 p.m. and leave ten minutes later.

The entire train from Houston has been reserved, but applications are being accepted in the event one or more cars are secured or that some reservations are canceled.

NEW.... Complete Line of Gorman-Rupp Heavy Duty Pumps

Challenging Any Pump, Size for Size to

PRIME AS QUICK
PRIME AS HIGH
PUMP MORE DIRTY WATER
MATCH PERFORMANCE

Gorman-Rupp Self-Priming Centrifugal Pumps have long led the field in dependability and performance. NOW! Gorman-Rupp goes further ahead with its new line of Heavy Duty Pumps.

Streamlined inside, where streamlining counts, they are the quickest priming, fastest pumping, never-quit pumps available.

For instance -- the new Model 40M 4″ pump primes at 20 ft. suction in just 33 seconds; 30 ft. suction in 67 seconds (sea level).

Gorman-Rupp's challenge is not idle talk. Our distributors will put a pump on the job alongside any other make, size for size. Unless our pump proves to be the best all around pump, its return will be accepted and the user paid for any installation expense incurred.

MID CONTINENT OIL FIELD REPRESENTATIVE

TOM L. TURNER

1335 MELLIE ESPERSON BLDG., HOUSTON 2, TEXAS

THE GORMAN-RUPP COMPANY

Hewitt Rotary Drilling Hose protects your profits with built-in, leakproof couplings

You're looking at profit protection in the making!

This Hewitt craftsman is building a leakproof coupling into a Hewitt Rotary Drilling Hose. He is building the coupling *into* the carcass of the hose, thereby making it an integral part of the hose wall. This assures a high-pressure seal and a completely rubber-lined, unrestricted fluidway throughout the entire hose. And it eliminates the need for external clamps!

But this profit-protection feature is only one of many which make Hewitt Rotary Drilling Hose so popular among oil men everywhere.

For example, its tough yet flexible carcass effectively withstands high pressures. And its strong cover resists stripping action and abrasion.

So choose the type of Hewitt Rotary Drilling Hose best suited to your needs . . . Monarch for deep well drilling, Ajax for medium well drilling, Conservo for slim hole drilling.

Write for detailed information. Address Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, New York. Or consult your nearest Hewitt distributor listed below:

Mid-Continent Supply Company
Norvell-Wilder Supply Company
Jarecki Manufacturing Company
Standard Supply & Hardware Co.
Bethlehem Supply Co. of California

HEWITT

ROTARY DRILLING HOSE

You can't buy better hose for oil well drilling!

1. ***Guaranteed test pressure!*** Monarch Rotary Drilling Hose is guaranteed on delivery to withstand test pressure of 5000 lbs. per square inch; Ajax, 4000 lbs.; Conservo, 3000 lbs. for 2½" I.D.; 2,000 lbs. for 3".

2. ***Leakproof couplings!*** Hewitt built-in couplings assure unrestricted, completely rubber-lined fluidway. No external clamps!

3. ***Special Inner Tube!*** The special-purpose, oil-resisting inner tube is specially compounded to resist abrasion and oil emulsion drilling mud. Tube, carcass, cover, couplings built to work as single unit.

4. ***Fits your needs!*** Available in three types—Monarch brand, 3-wire reinforcement; Ajax brand, 2-wire, and Conservo brand, 2-wire.

HEWITT RUBBER DIVISION **HEWITT-ROBINS INCORPORATED**

Annual ASME Meet to Feature Talks On Petroleum Synthesis

The annual meeting of the American Society of Mechanical Engineers, Petroleum Division, at the Herring Hotel in Amarillo, October 3-6, will feature a series of talks on petroleum synthesis. Among those expected to contribute are W. C. Schroeder, chief of the Office of Synthetic Liquid Fuels, Bureau of Mines; Dr. Alfred Clark, Phillips Petroleum Company; and Dr. C. W. Montgomery, Eugene Ayres, and Joe H. Hirsch, Gulf Research and Development Company.

The Production Engineering Committee plans to present papers by D. O. Johnson, Tulsa, on a new type dynamometer for well weighing; Jim Gregory, Shell Oil Company, Long Beach, on field control of oilfield equipment; J. R. Mahan, Director of Engineering, National Supply Company, on drilling rigs for deep wells.

Pipe Line Companies Committee Names Locke Associate Counsel

Gordon C. Locke has resigned as attorney for the Interstate Commerce Commission to accept an appointment as executive secretary and associate counsel for Pipe Line Companies Committee, an organization which represents pipe lines subject to ICC jurisdiction.

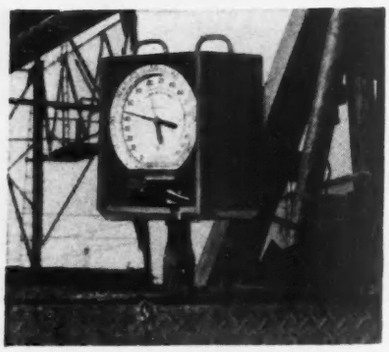
Annual Penn State Production Meeting Planned for October

The 12th annual Penn State conference on production of petroleum by artificial application of pressure to oil-bearing formations will be held in the School of Mineral Industries at the Pennsylvania State College October 14 to 16. The staff of the production research laboratories of the Pennsylvania Grade Crude Oil Association will cooperate in the program.

Dr. S. T. Yuster, chief of the school's division of petroleum and natural gas engineering, revealed here that progress made in the petroleum production research program at the college will be reported. The crude oil association is one of the principal sponsors of this research.

An opportunity will be offered for oil producers to discuss their problems among themselves as well as with members of the research staff.

NOW ...all types of small rigs can have the same weight indicator accuracy, sensitivity, ruggedness and dependability as a 15,000' rig with MARTIN-DECKER *production model* WEIGHT INDICATORS



A Portable Model Clipper Sealtite installed on an Indeco H 40 Rig. Portable models are ideal for any small space. Dimensions 14" x 17" x 12". Note convenience of handles. Can be installed permanently if desired.

A MARTIN-DECKER Production Model Weight Indicator can be placed anywhere you want it, at the brake, in front of the driller, over next to the line permanently attached to the mast, without danger of damage from dead line vibration or whip, and with it you can read your loads with precision in pounds. Equipped with super sensitive vernier for maximum sensitivity and readability.

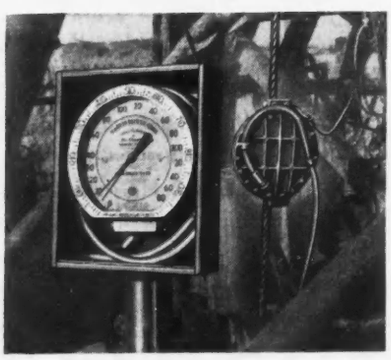
PRODUCTION MODEL CLIPPER SEALTITES OFFER THESE OUTSTANDING ADVANTAGES

RUGGED AND DEPENDABLE

SENSITIVE: Dependable, sensitivity adjustors permit just the right degree of sensitivity and readability. The Vernier Weight Indicator with 6 to 1 ratio is included and is available for fishing jobs, etc.

FACTORY-SEALED: Vacuum loaded at the factory and permanently sealed. No adjusting, no pumping up.

DIRECT READING IN POUNDS



The Clipper Sealtite above is permanently installed on a Hopper Blitz trailer mounted rig. Lowering the mast and moving in no way interferes with this installation.

Write for further information

MARTIN DECKER CORP. HOME OF THE WEIGHT INDICATOR

LONG BEACH, CALIFORNIA

SAN JOAQUIN VALLEY: T. J. CULLEN, BAKERSFIELD, CALIFORNIA
MID CONTINENT DISTRIBUTOR: REED ROLLER BIT COMPANY, HOUSTON, TEXAS

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946

Of WORLD OIL (Formerly—The Oil Weekly) published monthly at Houston, Texas, for October, 1948.

State of Texas, County of Harris, ss:

Before me, a Notary Public in and for the State and County aforesaid, personally appeared A. L. Burns, who, having been duly sworn according to law, deposes and says that he is the Business Manager of WORLD OIL (formerly the Oil Weekly) and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily, weekly, semiweekly or triweekly newspaper, the circulation) etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Ray L. Dudley, 3371 Chevy Chase, Houston, Texas; Editor, Warren L. Baker, 1613 Woodhead, Houston, Texas; Managing Editor, Albert B. Reese, Jr., 4029 Gulf, Houston, Texas; Business Manager, A. L. Burns, No. 7 Chelsea Place, Houston, Texas.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

The Gulf Publishing Company, Houston, Texas; James Anderson, Houston, Texas; A. L. Burns, Houston, Texas; J. F. Carter, Jr., Tulsa, Okla.; Mrs. Mary Margaret Cashman, Houston, Texas; Mrs. Carolyn Dodson Dudley, San Angelo, Texas; June Wooden Dudley, Trustee for Miss Fredrica Lucinda Dudley, Metuchen, N. J.; Ray L. Dudley, Independent Executor and Trustee of Estate of Dr. N. L. Dudley, deceased, Houston, Texas; Ray L. Dudley, Houston, Texas; Wm. G. Dudley, Houston, Texas; Mrs. Libbie Rice Farish, Houston, Texas; Wm. V. Gross, Utopia, Texas; Mrs. Anita S. Lane, Houston, Texas; Chas. H. Lane, Houston, Texas; Tom W. Nelson, Houston, Texas; Mrs. Maude G. Sterling, La Porte, Texas; O. R. Waller, Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockolders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is 17,775. (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

A. L. BURNS, Business Manager.

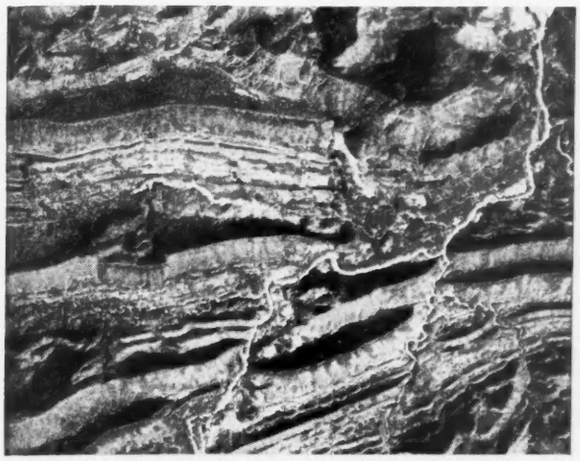
Sworn to and subscribed before me this 15th day of September, 1948.

P. J. AUCOIN,

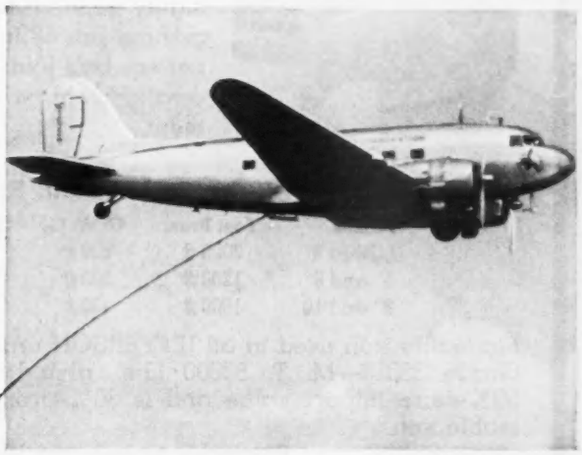
(Seal) Notary Public in and for Harris County, Texas.

(My commission expires June 1, 1949.)

AERO'S Complete Mapping Service for the Petroleum Industry!

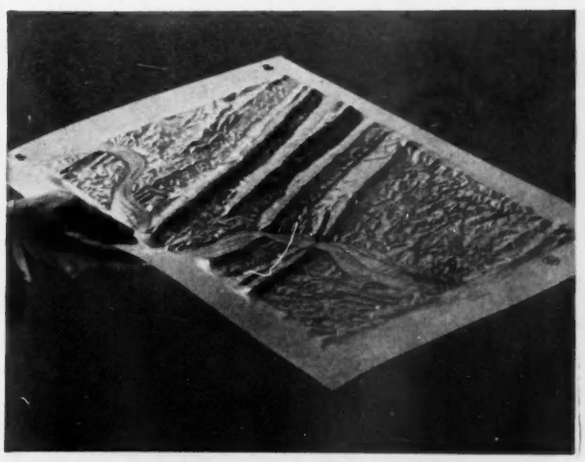


EXPLORATORY MAPPING: AERO's expert mapping teams serve the oil industry all over the world—in Africa, Canada, Alaska, Central and South America. For oil companies find our precise aerial photography valuable for geologic study, as well as development planning for pipe lines, highways and harbor facilities. From the base photography, we supply photo mosaics . . . photos for stereoscopic study . . . and topographic maps. Pictured above is a small section of our Venezuelan work, one of AERO's many foreign mapping assignments.



AIRBORNE MAGNETOMETER SURVEYS: For rapid reconnaissance of large areas. AERO's experience, dating back to 1943, includes magnetic mapping over all types of terrain in many parts of the world. The Gulf high sensitivity magnetometer is used. Magnetic maps, exactly related to ground positions, are delivered. Accuracy—variations smaller than 2 gamma are recorded.

REFINERY FACILITIES: AERO's photographs aid in the location of refinery sites and engineering planning for the construction of new facilities. AERO's 30 years' experience will be useful to you in this and other development planning.



PLASTIC RELIEF MAPS: AERO's broad services include the preparation of plastic relief models to suit your requirements, showing terrain features in dramatic relief. These maps are featherlight, durable, easily shipped.

AERO's photogrammetric engineers will be glad to meet with you, to discuss the application of time-saving, economical aerial photography to your mapping needs. Write for "You Can See More From The Air", which describes AERO's complete services.

Oldest Flying Corporation in the World

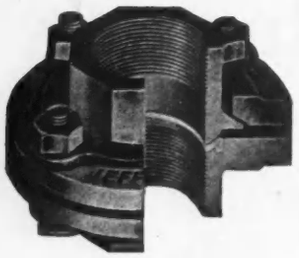
AERO SERVICE CORPORATION

VIRGIL KAUFFMAN, President

236 E. COURTLAND ST., PHILADELPHIA 20, PA.

AERIAL PHOTOGRAPHY • COLOR PHOTOGRAPHY • PRECISE AERIAL MOSAICS • AIRBORNE MAGNETOMETER SURVEYS • PLANIMETRIC MAPS • TOPOGRAPHIC MAPS • RELIEF MODELS

Jefferson Malleable Unions



STYLE "B"

JEFFERSON Style "B" three-piece flange union is made with brass-to-iron and iron-to-iron seats. Being made of highly refined AIR FURNACE iron, it assures you of lightweight construction, perfect ball joint, and positive seating arrangement, whether or not in alignment.

★ ★ ★

HYDRAULIC PRESSURE RATING

Sizes	Test Pres.	O. W. G.	S.W.P.-550 Deg.
½" thru 4"	2000#	800#	250#
5" and 6"	1200#	500#	250#
8" and 10"	1000#	400#	250#

Malleable iron used in all JEFFERSON unions meets ASTM-4733, Grade 35018—M. T. 53000 Lbs., giving 75%-more elongation 50%-more impact value and is 30%-stronger than cupola malleable iron.

Obtainable through your jobber

Jefferson Union Company, Inc.

691 West 26th St.,
New York 1, New York

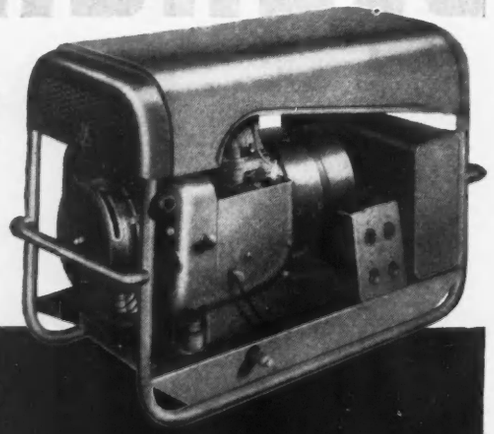
71 Gooding St.,
Lockport, New York

31 Fletcher St.,
Lexington, Mass.

DEPENDABLE

LIGHT & POWER

for Oil Field Service



AIR-COOLED HEAVY-DUTY

ONAN "CK" ELECTRIC PLANTS

Available in A.C. or D.C. models, conservatively rated at 3,000 watts, built for heavy-duty service but compact and light in weight (only 315 lbs.), Onan CK Electric Plants are replacing bulky, heavier units for drill rigs, well-servicing and other oil field uses. Equipped with convenient carrying frame for easy moving on the job. Driven by the Onan 10 hp, 2-cylinder opposed, air-cooled CK engine with Onan heavy-duty generator direct-connected. Self-rewinding Readi-Pull starter included as standard equipment. Other models available with manual, Readi-Pull or electric starting. Plug-in receptacles. Weather hood, hinged for easy servicing, protects plant.

Models for every oil field job

Lightweight: 500 to 3000 watts

Gas-gaso-powered: 3 to 35KW

Diesel Plants: 2½ to 35KW

Onan PRODUCTS

***Heavy-duty**, one and two-cylinder air-cooled models. Two, four and six-cylinder water-cooled models. Gas-gaso-powered: 350 to 35,000 watts. Diesel-powered: 2,500 to 35,000 watts.*

Write for Folder

D. W. ONAN & SONS INC.
5342 Royalston Ave. Minneapolis 5, Minn.

ASSOCIATIONS

Oilwell Drilling Contractors Form Tenth District Chapter

The tenth district chapter of American Association of Oilwell Drilling Contractors was formed September 10 when Dallas and Fort Worth oil men held an organizational luncheon meeting in Dallas.

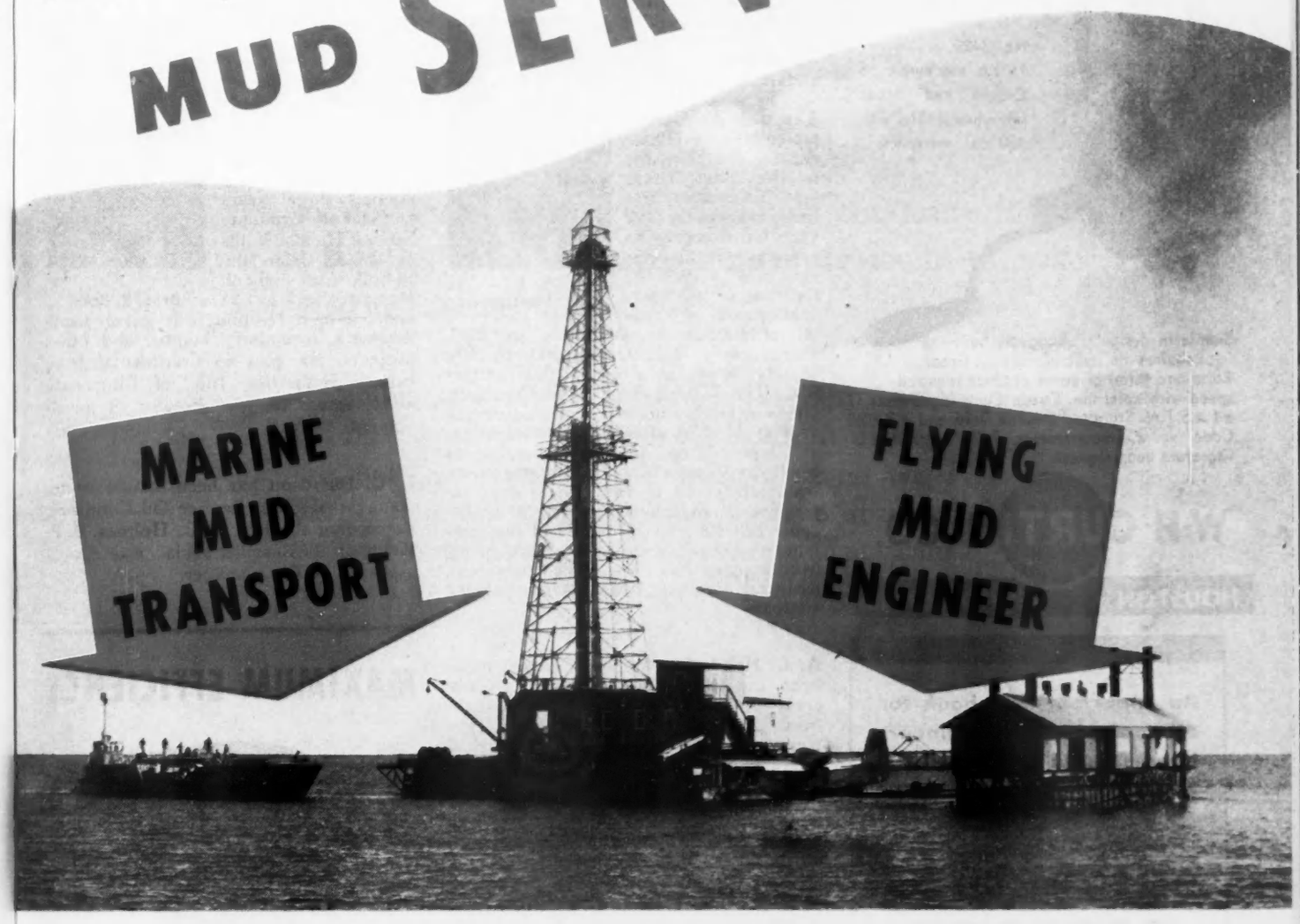
The group elected Louis A. Beecherl, McDaniel & Beecherl, Dallas, chairman. Thomas J. Carter, Thomas J. Carter Drilling Company, Dallas, was elected vice chairman, and R. V. Everidge, Davidson Drilling Company, Fort Worth, was chosen secretary.

THE OIL MAN'S CALENDAR

OCT. 3- 6	American Society of Mechanical Engineers, Petroleum Division, Amarillo, Texas, Herring Hotel.
4- 6	American Institute of Mining & Metallurgical Engineers, Petroleum Division, Fall Meeting, Dallas, Adolphus Hotel.
4- 9	American Association of Petroleum Geologists, Midyear Meeting, Pittsburgh, Pa.
4- 9	American Gas Association, Annual Convention, Technical Section, Atlantic City, Ambassador Hotel.
5- 6	Oil Industry Information Committee, New York.
8	California Natural Gasoline Association, Annual Fall Meeting, Ambassador Hotel, Los Angeles.
11-13	American Association of Oilwell Drilling Contractors, Annual Meeting, Houston, Rice Hotel.
14-15	Indiana Independent Petroleum Association, Fall Convention, Indianapolis, Ind., Hotel Severin.
14-15	Texas Mid-Continent Oil and Gas Association, Annual Meeting, Fort Worth.
14-15	American Institute of Mining & Metallurgical Engineers, Petroleum Division, Fall Meeting, Los Angeles, Elks' Club.
24-26	Tennessee Oil Men's Association, Fall Convention, Peabody Hotel, Memphis.
26	Independent Natural Gas Association of America, Annual Meeting, Mayo Hotel, Tulsa.
29-31	West Texas Geological Society, Field Conference, Big Bend Region of Southwest Texas.
NOV. 3- 4	American Society of Mechanical Engineers, Fuels Division, Green Brier Hotel, White Sulphur Springs, W. Va.
8-11	American Petroleum Institute, Annual Meeting, Chicago, Stevens Hotel.
MAR., 1949 9-11	American Petroleum Institute, Southwestern District Meeting, Galvez Hotel, Galveston, Texas.
23-25	American Petroleum Institute, Mid-Continent District Meeting, Mayo Hotel, Tulsa.
24-25	New England Gas Association, Boston, Hotel Statler.
APRIL, 1949 12-14	Southwestern Gas Measurement Short Course, College of Engineering, University of Oklahoma, Norman.
13-15	National Petroleum Association, Hotel Traymore, Atlantic City, N. J.
27-29	American Petroleum Institute, Eastern District Meeting, William Penn Hotel, Pittsburgh.

Nomads Chapter monthly meetings: **Los Angeles**, second Wednesday, Jonathan Club. B. M. Landis, Secretary. **Houston**, second Monday, Houston Club. Harry E. Estes, Secretary, Telephone Charter 4-7611. **Dallas**, L. A. Little, Secretary, Telephone Justin 8-1726. **Tulsa**, third Wednesday, Hotel Tulsa, Anthony Gibbon, Secretary, Telephone 3-1844. **New York**, first Monday, Louis Sherry's, Norris Boulden, Secretary, Telephone WIcersham 2-1311, extension 260.

HOW'S THIS FOR MUD SERVICE!



This unusual photograph illustrates the extent of Magcobar facilities for serving drilling barges along the Texas-Louisiana Gulf Coast.

At left, a converted "LCT," operated by The Mud Supply Company, a Magcobar dealer at Houma, Louisiana, approaches a rig in Terrebonne Bay with a cargo of Magcobar mud products. At right, the Magcobar "Mud Hen," amphibious airplane piloted by an experienced mud engineer, comes in for a landing to make a routine check of the drilling mud.

By land . . . by air . . . by sea—no matter how remote the location, you can depend on Magcobar field service.

Magcobar

Complete

DRILLING MUD SERVICE

MAGNET COVE BARIUM CORPORATION

Malvern, Arkansas — Houston, Texas

Export Representative: Guy E. Daniels, 30 Rockefeller Plaza, New York, N. Y.

Macgobar • Magcogel • High Yield Drilling Mud • Xact Clay • Magco-Fiber • Magco-Mica
Tannathin • Jel-Oil Mud • Jel-Oil "E" • Salt Gel • Noheev • Seal Flakes • My-Lo-Jel • Chemicals

QUICK, ACCURATE RESULTS
LESS EFFORT
Curtin CENTRIFUGES

No. 3420
15 c.c. machine . . .
Cranks and heads interchangeable with 100 c.c. machines.

Simple in design . . . Ruggedly built . . . Requires no special care . . . Great Ratio and throw of crank produce required speed with no strain. Curtin Centrifuges meet all A.S.T.M. Standard Method D-96 and A.P.I. Code No. 25 requirements. Fully descriptive literature upon request.

W·H·CURTIN & CO.
HOUSTON . . . . NEW ORLEANS.

An important new book for oil geologists and engineers interested in the oil possibilities of the continental shelves

SUBMARINE GEOLOGY

By Francis P. Shepard

The increasing importance of oil deposits on the continental shelves makes this new book a "must." The first full and authoritative volume on the floor of the ocean, waves and currents, shorelines, coral reefs, etc. Fully illustrated with photographs and charts.

338 Pages • $6.00

HARPER & BROTHERS
49 East 33d St., New York 16

Men in the Industry NEWS

R. N. Montgomery, vice president and general superintendent of The Illinois Pipe Line Company of Texas, has retired after 39 years service with the company and its affiliates. He will be succeeded by **Samuel A. Click,** presently superintendent for the company in the East Texas field. Montgomery was first employed by The Ohio Oil Company as a pumper in the Illinois field in 1909. At the time of the early development of crude oil production in Wyoming in 1917, Montgomery was transferred to Big Muddy, Wyo., as a district field gauger with The Illinois Pipe Line Company. He successively became district foreman at Big Muddy, division superintendent at Casper, Wyo., and superintendent at Shelby, Mont. In 1927 Montgomery was transferred to Del Rio as superintendent of operations, and in 1937 he became general superintendent of the company's Texas operations. Since 1942, Montgomery has been a vice president, assistant treasurer, and director of the company.

R. N. Montgomery

⌄⌄

A. L. Henderson has been named manager of Ohio Oil Company's newly created division which will consolidate production operations in four of the company's Eastern divisions. Located at Terre Haute, Ind., the division includes Michigan, Illinois, Indiana, Ohio, Kentucky, Tennessee, Pennsylvania, Virginia, and West Virginia. Associated with Henderson in the new division office will be **I. G. Burrell,** division production superintendent; **W. E. Schoeneck,** division petroleum engineer; **R. E. Knipe,** division geologist; **E. J. Giffel,** division land man; **N. L. Battensclag,** division controller; **J. J. Diver,** division attorney; and **E. B. Peters,** supervisor of personel.

⌄⌄

John J. Willenburg has been promoted from assistant area superintendent for Stanolind Pipe Line Company to superintendent in charge of all its operations in Illinois and Indiana. Willenburg succeeds **C. E. Scneder,** who has retired after 31 years of active service with the company. Illinois-Indiana headquarters will continue to be Galesburg, Illinois. Except from 1918 to 1922, when he worked for other pipe line companies and for drilling contractors, Willenburg has been an employee of the company since 1916, the year it was established.

John J. Willenburg

Dr. E. R. Baker, widely known industrial chemist and wartime assistant research chief in chemical warfare, has been appointed manager of Continental Oil Company's newly-created Central Research Laboratories. Baker received his B.S. degree in chemistry from Yale University and studied three years at the Yale Graduate School. He also holds an LL.D. from the Suffolk Law School. During the war he assisted in developing war gases, flame throwers, incendiary bombs, and other projects. He goes to Continental from Emery Industries, Inc., of Cincinnati, Ohio, where he was director of development.

Dr. E. R. Baker

⌄⌄

L. C. Davidson has been named traffic manager of Cities Service Oil Company, succeeding the late **A. C. Holmes. S. P. Kelly** of Bartlesville, Okla., was named assistant traffic manager.

MAXIMUM EFFICIENCY

for DRILL COLLARS, TOOL JOINTS, PIPE JOINTS

DRA-LED is anti-galling and gives positive protection against drill collar washouts. Will stand high pressures.

FOR OIL, WATER OR GAS

Manufactured by
C. H. DRAGERT COMPANY, Inc.

Distributed by
THE CONTINENTAL SUPPLY CO.

We are sorry . . .

for any inconvenience we may cause our many friends in the oil business, but it has become necessary for us to make the following statement:

> Recently, we announced in the trade journals that Oil Base, Inc., was distributor for Koebelite diamond bits and core barrels. As of now, we are no longer distributing, selling or servicing Koebelite diamond bits and core barrels or any other equipment manufactured by the Koebel Diamond Tool Company of Detroit.

Black Magic oil base drilling fluid, Oil Base hand cleaner and OB Mud Guns, which we manufacture, will be distributed and serviced by our staff in the same efficient manner as in the past. We emphatically suggest that you use Black Magic not only during your diamond coring programs but wherever water is in contact with and can water-block the producing zones.

Signed, September 16, 1948

OIL BASE, INC., *Compton, Calif.*

GEO. MILLER, President
J. A. MOORE, Vice President
J. A. HENDERSHOT, Secretary
E. N. STEELE, Bakersfield
ROBERT EDWARDS, Ventura
A. K. BROWN, Casper, Wyo.
JACK LONG, Houston
THAD RANDOLPH, Oklahoma City
RALPH RUSE, Midland
CHARLES PISKAC, Long Beach
R. WHITE, Long Beach
ARCH RATER, Walters, Okla.
THOMAS HECK, Houston

"I like WORLD OIL because I can flip right to the Drilling Section and be sure that every page—editorial and advertising alike — concerns information of top interest to me as a drilling contractor."

That comment hits the nail on the head and is just as true for a production or pipe line man as it is for the drilling contractor. WORLD OIL's sectionalization plan (six sections, each with its own cover and each devoted to a special phase of the oil industry) makes it—more than ever before—THE specialized paper devoted entirely to drilling, producing, pipe line operations and management.

Back copies of WORLD OIL are rarely available. To avoid missing a copy and to keep your files complete—renew your subscription promptly. If you are not a subscriber in your own name, fill out the order blank below and send it in TODAY!

I want to receive **WORLD OIL**

(Established 1916 as The Oil Weekly)

here's my check for

☐ 3 years for $4.00
☐ 2 years for $3.00
☐ 1 year for $2.00

NAME_____ POSITION_____

COMPANY_____

STREET & NO._____

CITY & STATE_____

Check branch of industry

☐ Drilling Contractor ☐ Individual Producer
☐ Producing Company ☐ Manufacturing
☐ Pipe Line ☐ Supply

Return to **P. O. Box 2608** **Houston 1, Texas**

MEN IN THE INDUSTRY NEWS

W. O. Harris, former scout for Phillips Petroleum Company in Louisiana with headquarters at Shreveport, has resigned and joined the scouting department of Union Oil Company. He replaces **Bill Farrar,** who has been transferred to Union's land office at Houston.

C. D. Speed, Sr.

C. D. Speed, Sr., of Corsicana, Texas, last month became the first individual ever to produce oil 50 years continuously in Texas. No major or semi-major oil company can equal this record as these companies did not enter the Texas oil picture until after the discovery of Spindletop in 1901. At one time Speed owned seven wells, all producing from the Taylor marl of Upper Cretaceous age. Three of these wells are still producing and one of them (pictured above in Speed's front yard) has been producing regularly for 50 years. Drilling methods were radically different then from what they are today, as drill stem, oil well cementing processes, and the rotary drilling rig were not yet in use. Speed's father, **L. E. Speed,** was associated with him in drilling and producing at the turn of the century, and his uncle, **Tom Stribbling,** was a successful wildcatter who had drilled 100 producers before moving to Beaumont at the time of the Spindletop discovery. Speed believes that the Navarro and Taylor marl formations in Navarro County will continue to yield oil in substantial quantities for some time to come.

J. H. Osborne has been promoted to division gravity meter supervisor for Stanolind Oil and Gas Company in the Rocky Mountain area with headquarters at Casper, Wyo. **E. W. Price** has been named district geologist in Stanolind's Oklahoma district office, succeeding **G. H. Galloway,** who was recently named Central division geologist.

HERE IS THE ROTARY HOSE YOU HAVE BEEN WAITING FOR

For years, you men in the drilling industry have asked for a rotary hose that was flexible enough to handle and transport easily and yet strong enough to withstand high pump pressures. Goodall's Flexo Rotary Hose is your answer!

New-Type Construction

Because of the new-type construction of Flexo Hose, it does not depend on tightly wrapped wires for strength and is not weakened by bending. It can easily be coiled in loops of thirty inches in diameter without the slightest damage —yet it holds full test pressure with less elongation than the old types.

Easy to Transport

It is so flexible it is shipped in a 63-inch crate. It safely withstands bending that would immediately ruin ordinary hose.

Goodall Repair Service

Goodall maintains a repair department in Houston, Texas, and is the *only* rotary hose manufacturer to offer a complete repair service. This service, combined with the advanced features of Goodall "Flexo" Rotary Hose and Barney Couplings make Goodall the favorite with oil companies and drilling contractors everywhere.

BARNEY COUPLINGS—the only couplings stronger than the hose—are standard on Goodall Flexo Rotary Hose.

Stocked at all distribution points

GOODALL RUBBER COMPANY — TRENTON, N. J.

GOODALL RUBBER COMPANY OF TEXAS: Houston, Texas

GOODALL RUBBER COMPANY OF CALIFORNIA: San Francisco, Los Angeles, Seattle, Salt Lake City

EXPORT: Goodall Rubber Company, Trenton, N. J.

DISTRIBUTORS: Texas and Louisiana — Houston Oil Field Material Co. — Wilson Supply Co. Oklahoma — Iverson Supply Company

Edward G. Voss has been elected assistant treasurer of Arabian American Oil Company. Voss will make his headquarters in San Francisco. He started as an office boy with the Standard Oil Company of New Jersey in 1934 and in 1946 was made head of that company's investment and finance division.

Edward G. Voss

K. F. Krammes has been promoted to district geologist in the Bakersfield, Calif., area for The Texas Company. Krammes is succeeding **Z. B. Snedden,** who has been transferred to Houston as assistant manager of the geophysical division, Producing department. Krammes started his career in the oil business in 1936 as junior geologist for the Union Oil Company of California and then served with Superior Oil Company as geologist from 1937 to 1940. He entered the employ of The Texas Company in 1940 as assistant geologist and advanced to geologist in May, 1943.

Claude E. Swift has been elected vice president of Union Oil Company of California and will be in charge of research and patents. Previous to his appointment, Swift was manager of research and patent counsel. A graduate of the University of Southern California, he came to Union in 1926 as a senior inspector in the research department. Since that time he has advanced from a junior chemist (1927), assistant chemist (1930), chemical engineer in patent counsel (1930), patent engineer (1934), patent attorney (1935), assistant patent counsel (1938), patent counsel (1939), and counsel to managership in 1947.

Claude E. Swift

»

Pliny del Valle, formerly superintendent in the Houston land office of Continental Oil Company, has been appointed assistant to **W. C. Stout,** assistant manager of the land department there. **William G. Carlile,** formerly assistant superintendent at Houston, has been named superintendent. **G. Denton Moore** formerly a land man, becomes assistant to the superintendent. With Continental since early in 1944, when he joined the company as district land man at Corpus Christi, del Valle was transferred later in the same year to Houston as assistant superintendent and later became superintendent. Carlile was employed by other oil firms in land and legal work prior to joining Continental in 1947. Moore, a graduate of the Indiana Law School, practiced law before coming to Continental in 1937.

»

Dr. Max A. Bornhauser has been promoted to research geologist by Continental Oil Company and will head the new exploration research department of the Gulf Coast division at Houston. He has been district geologist for the past 12 years at Lafayette, La. Born in Switzerland, he started working for Shell in 1927 in Holland, coming to America in 1930. He joined Continental as Louisiana district geologist in 1934, opening the district office.

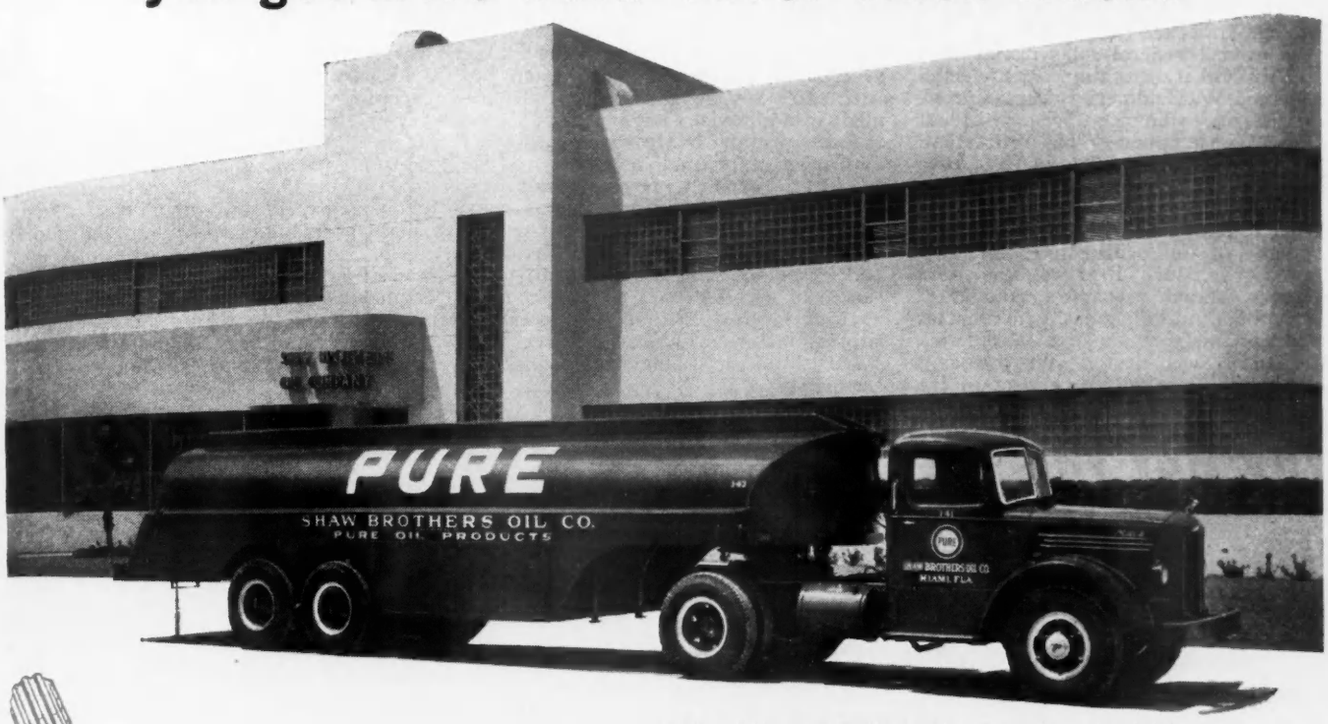
Dr. Max A. Bornhauser

»

C. L. McArthur, Jr., district landman at Lion Oil Company's Abilene, Texas, office, has been placed in charge of a newly-opened Corpus Christi office as district landman there. **Louis Weltman** has been transferred from the Jackson, Miss., office to assume the duties of district geologist in the office at Corpus Christi.

Here's the Mighty Hook-up for Improved Drilling!
THE 36-200 REGAN Narrow-Type Traveling Block and Forged Steel Combination Casing Hook
200-TON CAPACITY
...but only 135½" from bight of hook to top of traveling block—the shortest overall working height ever offered for such capacity!
ADVANCED DESIGN
Special adapter reduces friction, allowing the forged alloy steel combination hook to smoothly swivel at the right angle to traveling block sheaves. The traveling block is compact, narrow, streamlined for maximum safety and ease of operation.
FITS PORTABLE RIGS
Being four feet shorter, narrow and compact, this new Regan Combination is perfectly suited to portable drilling operations.
Write today for your copy of our new fully informative bulletin!
Regan
Quality - Wrought on the Forge of Experience
2-C
Forge & Engineering Co.
SAN PEDRO, CALIF.
HOUSTON, TEXAS
Exclusive Mid-Continent Representatives:
Hunt Tool Co.,
P.O. Box 1436, Houston, Texas
Exclusive Export Representatives:
Hunt Export Co., 19 Rector St., New York, N. Y.
Avda Pte., R. Saenz, Pena 832, Buenos Aires, Argentina

you get more work out of Mack Trucks



Modern is the word for the handsome quarters occupied by Shaw Brothers Oil Co., Miami, Florida. **Modern,** too, describes their streamlined Mack Model LFT tanker—5800 gallons capacity and the last word in efficient, economical hauling.

because..we put more work into Macks

There is no guesswork about the stamina of Mack parts. This testing machine determines the strength and elasticity of Mack axle shafts by imposing measured torque up to point of fracture. Sample shafts are tested to destruction, thus insuring that all Mack shafts fully measure up to Mack's exacting standards.

Mack

trucks for every purpose

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts. In Canada, Mack Trucks of Canada, Ltd.

6218-1

SINCE 1900, AMERICA'S HARDEST-WORKING TRUCK

Marc F. Braeckel, who has been vice president and general sales manager of Richfield Oil Corporation was elected to succeed **W. Chalmers Burns** as president. Burns, who has been president since 1935, announced his retirement. Braeckel came to Richfield in 1930, after having been affiliated in various capacities since 1924 with other petroleum companies, including the Richfield Oil Company of California. In Richfield of New York, Marc Braeckel has been treasurer, branch manager, manager of distribution and bulk sales, general sales manager, and vice president. **Frederick H. Meeder** was elected vice president to succeed Braeckel. An expert in the fields of terminal operation, product quality control and product distribution, Meeder will continue as manager of Richfield's Traffic and Product department in addition to his executive duties as vice president. **Howard G. Meyers** has been appointed assistant to the president. Formerly merchandising manager, Meyers will now function as manager of marketing operations. **Ralph Glock** has been named sales manager. Glock, before his latest promotion, served at various times as district manager of several of Richfield's sales territories including those of lower New York state and Connecticut and the Carolinas.

John M. B. Howard has been appointed assistant manager of Standard-Vacuum Oil Company's marine department. Howard had extensive experience with Jersey Standard's world-wide marine operations prior to joining Standard-Vacuum. Starting as a deck officer on tankers in 1933, he later received his master's papers and went on to occupy shore posts at New York, Baltimore, Baton Rouge, Houston, Caripito Aruba, and other oil ports. His most recent assignment was in London as assistant general manager of Esso Transportation Company, a Jersey Standard affiliate.

James P. Malott

Edwin A. Austin

James P. Malott has been promoted from region petroleum engineer to assistant region manager of the Houston region of Continental Oil Company's production and drilling department. **Edwin A. Austin,** formerly district petroleum engineer at Basile, La., has been named to succeed Malott as region petroleum engineer at Houston. Malott, who went to Houston in 1939 as petroleum engineer, has been with Continental since 1935. He served as utility man, head roustabout, junior petroleum engineer, and petroleum engineer. Austin, a native of Haddonfield, N. J., received his petroleum engineering degree from the Colorado School of Mines. He joined Continental as roustabout in Tepetate, La., in 1939.

Ray Althouse, formerly office manager for the Production division of Cities Service Oil Company in Bartlesville, Okla., has been promoted to executive assistant in the company's executive department with **M. R. Shaffer Jr.** succeeding to his old post. **A. W. Page Jr.** has been named assistant to **Gerald R. Preston,** assistant treasurer in charge of the acquisition of oil properties. **Jack A. Cleverly,** formerly assistant division superintendent of the Production division at Oklahoma City, has been promoted to assistant to **C. E. Beecher,** general superintendent at Bartlesville. **E. E. Ives,** formerly assistant division superintendent for Southern Oklahoma, Seminole, and Northern Texas, has been promoted to assistant division superintendent for the Oklahoma and Seminole districts.

Vitale Ricciardi, assistant manager of marine operations for The Texas Company, has been appointed manager to succeed the late **A. S. Angus. James V. C. Malcolmson** has been named manager of the construction and repair division of the marine department.

why not the Best in Swivels?

Be Sure IT'S A KING Be Safe

KING SWIVELS 53-GA, 32-GA AND 20-GW

THE PRINCIPAL USES OF THESE SWIVELS ARE:

1. **Drilling shallow and medium depth oil wells.**
2. **Drilling water wells.**
3. **Core Drilling and Geophysical Drilling.**
4. **For slim hole drilling.**
5. **Working over oil wells.**
6. **Washing down pipe and tubing.**
7. **Running with inside pipe cutting tools.**
8. **Running with fishing tools.**
9. **As all purpose, lightweight swivels.**

Types 32-GA, 53-GA and 20-GW swivels are alike in general design, but vary somewhat in detail.

These swivels have been field proven by several years of service and have been accepted as leaders in their class. They are in service throughout most of the oil world.

There are no other swivels which are comparable on a basis of capacity in proportion to weight.

Their high capacity in relation to their lightness makes them ideal for use in remote and inaccessible places.

The 53-GA is used for drilling medium depth oil wells; also used extensively on work-over rigs. It is an ideal swivel for slim hole drilling.

The 32-GA is used with large water well rigs and for drilling relatively shallow oil wells. It is also used with long strings of tubing for washing down and similar operations.

The 20-GW swivel is used for drilling shallow and medium depth wells. The 20-GW is the smaller of the three and is used on water wells, core drilling rigs and the heavier types of Geophysical Rigs. It is also suitable for handling tubing in the shallower oil fields.

All materials used in King Swivels are the best and most suitable for their purpose. Lubrication is provided and all connections are to API specifications or to the order of the customer.

Order Through Your Supply Store

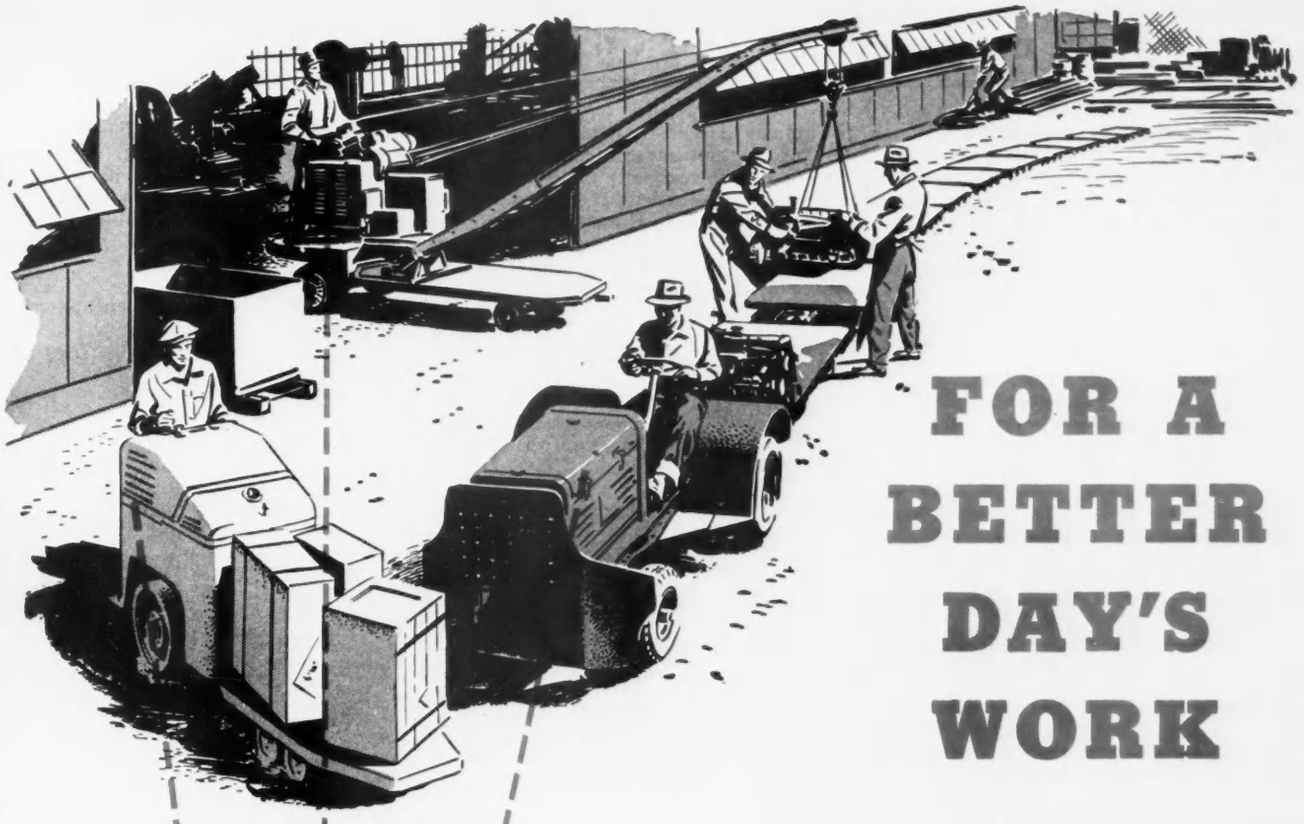
EXPORT: R. S. STOKVIS & SONS, INC.
17 Battery Place, New York 4, N. Y.

See 1948 Composite Catalog (Pages 2129 to 2140) for other King Tools

KING OIL TOOLS

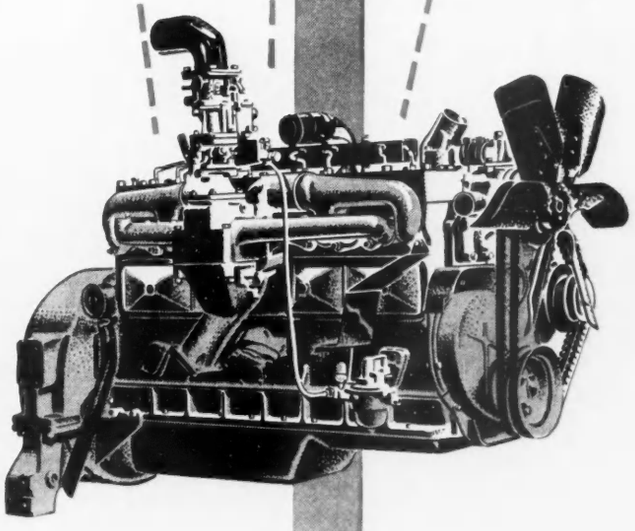
210 TERMINAL STREET PHONE W. 6-8013

HOUSTON 10, TEXAS



FOR A BETTER DAY'S WORK

IN INDUSTRY—ON FARMS—IN OIL FIELDS—IN FORESTS AND ON THE HIGHWAYS!



● The job of keeping America's production lines rolling calls for power that knows no quitting time . . . power that serves *every* shift efficiently and economically. That's why you'll find Chrysler Industrial Engines and Power Units serving American industry in cranes, lift trucks, tow trucks, pumps, air compressors and arc welders. The manufacturers of industrial equipment know that each Chrysler Industrial Engine is the result of the engineering and production skill of Chrysler Corporation. They know from experience that Chrysler Industrial Engines are built to deliver A Better Day's Work!

NATION-WIDE SERVICE

FACTORY - ENGINEERED AND TESTED PARTS WITH EXPERT MAINTENANCE WHEREVER YOU ARE

CHRYSLER

INDUSTRIAL ENGINES

HORSEPOWER WITH A PEDIGREE

INDUSTRIAL ENGINE DIVISION, CHRYSLER CORP., 12200 E. JEFFERSON, DETROIT 31, MICH.

Frank Lindeman Jr., assistant division production superintendent, has been placed in charge of offshore operations for Stanolind Oil and Gas Company. **Lawrence T. Haugen** is the marine superintendent and **Thomas E. Boyce** is marine operating superintendent. **Samuel C. Oliphant** has been made assistant division production superintendent in charge of onshore operations in the Gulf Coast division. Lindeman, a graduate of Colorado School of Mines, joined Stanolind in 1933. He became assistant division production superintendent at Houston in June, 1947, and had a similar post at Oklahoma City before that. Oliphant was named acting assistant division production superintendent in June. He joined the company in 1940 and was district superintendent at Corpus Christi prior to coming to Houston 2½ months ago. Haugen has been construction superintendent of the company's Manufacturing department in Tulsa. He is a graduate of the U. S. Naval Academy and holds an M.S. Degree in naval construction from Massachusetts Institute of Technology. Boyce joined the company in March. He is a graduate of the Naval Academy and has an M. S. Degree in mechanical engineering from Columbia University.

Derek Allan Hough has been appointed general secretary of the Institute of Petroleum. **George Sell** has been appointed editor of the Institute's publications. Sell has been publications secretary since March, 1946.

»

Charles R. Brown has been appointed a vice president of Tide Water Associated Oil Company. Brown has served as assistant to the president for many years and is a member of the company's Western division operating committee. He will continue his general administrative duties with direct responsibility for many of Tide Water Associated's administrative departments in the Western division.

Charles R. Brown

»

A. S. Runacres has been appointed general manager and a director of Regent Oil Company, Ltd., distributors of Regent and Caltex petroleum products. He was formerly a director and general manager of the Texas Oil Company Ltd., which merged with the marketing side of Trinidad Leaseholds Ltd. and changed its name to Regent Oil Company Ltd.

»

F. A. Graser, formerly associate professor of petroleum engineering at the Missouri School of Mines, has accepted the position of chief geologist with Cleveland Oil Company, Los Angeles. Previous to his position with the Missouri School of Mines, Graser had been a consultant at Long Beach, Calif.

»

Harry Ross has been named executive assistant to **J. Frank Wilson,** vice president of Sohio Petroleum Company and Standard Oil Company (Ohio). Ross, who will have headquarters in Tulsa, has had experience as an independent producer and as production superintendent for The Texas Company. For the past years he has been associated with Dowell Incorporated and Dow Chemical Company.

»

J. Roy Auers has been appointed manager of Warren Petroleum Corporation's North Texas division with headquarters at Wichita Falls. Other personnel in the new division include **Jack L. Coulson,** assistant to **Jack Dunn,** production superintendent; **D. R. Ward,** formerly with Continental Oil Company, in charge of purchasing and materials inventory; **A. J. Evans,** division drilling superintendent, with **J. W. Modrall,** assistant; and **J. P. Hamman,** division engineer. Warren has also established a production district at Graham, Texas, with **Sherman Fehl** in charge. He will have as his assistants **S. H. White,** foreman in charge of operations in the Jack County area, and **G. K. Hall,** foreman in charge of operations in western Young County.

Bottom Water is a drain on profits

Eagle Lead Wool

shuts out Bottom Water!

To insure an uninterrupted flow of oil from your wells, banish bottom water with economical Eagle Lead Wool. This finely stranded metallic wool, tamped around the hole, effectively seals every crack, becomes a permanent, non-corrosive plug. Packed in convenient 50-pound sacks—easy to place in special cartridge-shaped Eagle Wire Containers sized to fit all casings.

These 3 Eagle Bearing Metals meet most requirements

Eagle Dreadnaught — for extreme speed and heavy-duty conditions.

Eagle Outlasta — for medium speed and average-load conditions.

Eagle Durable—for low speed and light-duty conditions.

EAGLE LEAD WOOL

Seals off Bottom Water—

keeps 'em flowing!

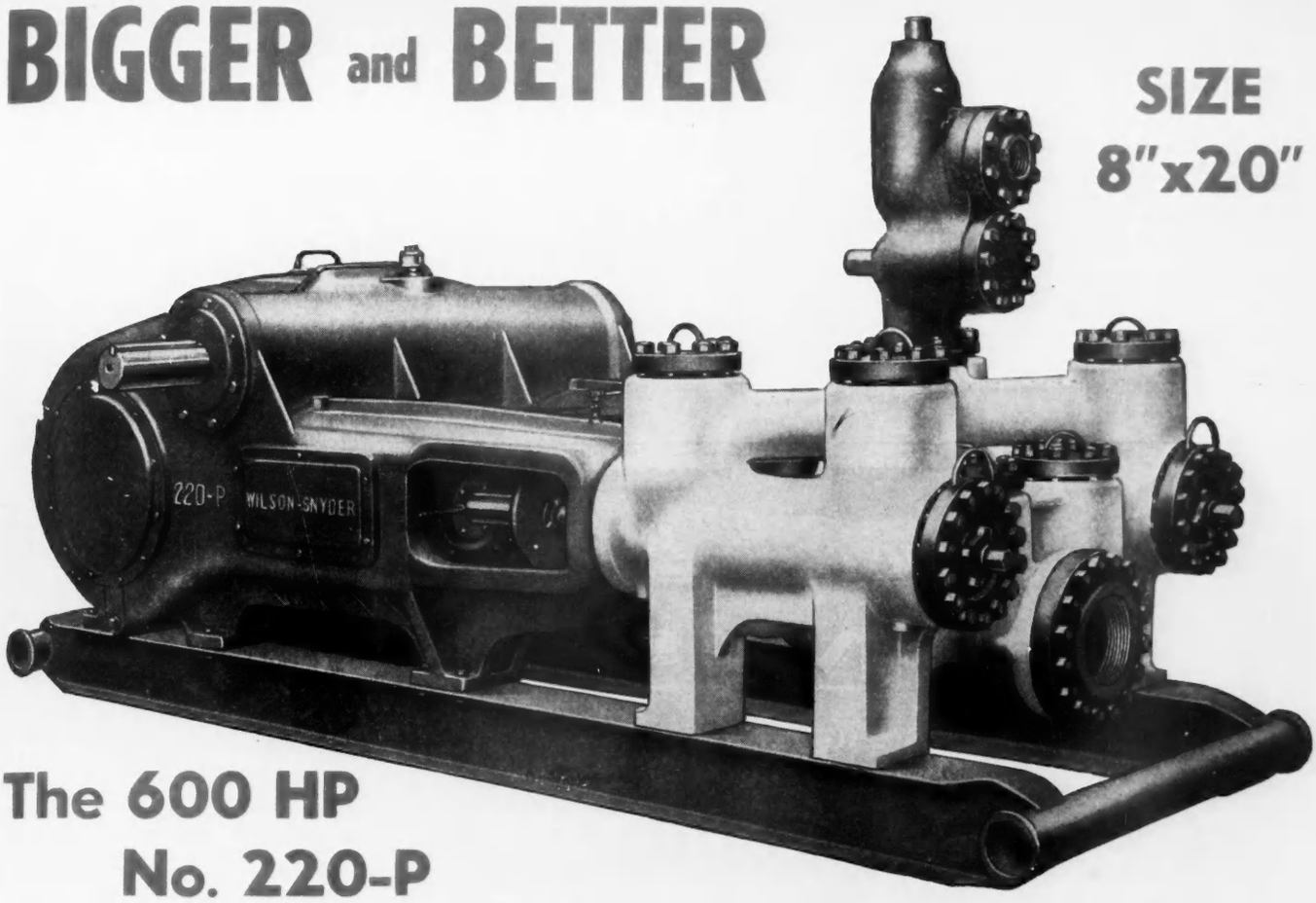
THE EAGLE-PICHER COMPANY

EAGLE Since EP 1843 PICHER

Cincinnati East St. Louis Chicago . Dallas . Kansas City

BIGGER and BETTER

SIZE
8"x20"



The 600 HP
No. 220-P

WILSON-SNYDER POWER SLUSH PUMP

Here is a Power Slush Pump built for the heavy duty work that present drilling demands. It has a greater capacity and a greater horsepower.

Naturally it is larger and more powerful.

Some of the many Wilson-Snyder features found in the No. 220-P are: (1) single helical gears with shafts set in adjustable tapered roller bearings, (2) oil bath lubrication, (3) grease lubricated crosshead pin bearings, permitting lubrication without shutting down, (4) special arrangement of the diaphragm packing and the mud baffle, (5) deep stuffing boxes, designed for rod lubrication, (6) Di-Hard Liners with Tell-Tale Liner Packing and Heavy Duty Liner Spacers with outside adjustment, (7) Heavy Duty Fluid Valves.

Maximum Fluid Cylinder Liner Bore x Strike	inches	8 x 20
Rated Working Pressure of Fluid Chamber Discharge	p.s.i.	4000
Maximum Working Pressure with Full Size Liner	p.s.i.	880
Rated Speed Full Size Liners	r.p.m.	60
Theoretical Capacity (Piston Rod Deducted) at Rated RPM	g.p.m.	990
Recommended Brake Horsepower	b.h.p.	600

Call or Write Houston Headquarters or your nearest Wilson Store for additional information.

Exclusive Distributors—Louisiana and Texas Gulf Coast

WILSON SUPPLY COMPANY

1412 MAURY ST., HOUSTON, TEXAS

SALES OFFICES: Tulsa, Oklahoma; Dallas, Texas. SANTA FE SPRINGS, CALIF.: Atlas Production, Inc., 1126 Lakeland Road.

BRANCH STORES: TEXAS—Kilgore, Beaumont, Barbers Hill, Bay City, Monahans, Alice, Victoria, Corpus Christi, Columbus. LOUISIANA—Lake Charles, New Iberia, Harvey, Shreveport, Houma. ARKANSAS—Magnolia.

Charles K. Clark has been named chief geologist of Michigan Oil Company. Since 1930, Clark has been a geologist and geophysical consultant for the Pure Oil Company. Michigan Oil Company is a subsidiary of Bay Refining Corporation with headquarters in Saginaw, Michigan.

»

Hal G. Sehnert, geologist with Sun Oil Company, has resigned to join Sohio Petroleum Company at Evansville, Ind.

Charles L. Schneider, formerly with the Virginia Gas and Oil Company at Charleston, W. Va., has joined The Pure Oil Company at Tulsa as assistant production engineer.

»

A. D. Turquette, former assistant district geologist at Oklahoma City for Phillips Petroleum Company, has resigned to become assistant division geologist for Globe Oil and Refining Company in Oklahoma.

O. I. Torkelsen has been promoted to vice president in charge of the Western division for British-American Oil Producing Company. **J. E. Matter** also has been promoted to vice president and will have charge of exploration in the Western division.

»

Harold I. Hoover, formerly superintendent of the East Chicago terminal, Phillips Petroleum Company, has been appointed technical assistant to the products pipe line division, a newly-created post in the Bartlesville, Okla., headquarters. He has been succeeded in Chicago by **W. E. Staton.**

»

Dr. Michael J. Rzasa, who received his Ph. D. in chemical engineering from the University of Michigan in 1947, has been named research group supervisor in the Research department of Stanolind Oil and Gas Company in Tulsa. He will head a new group called the Hydrocarbon Phase Equilibria Group.

Transfers:

Richard Freer, district geologist at Shreveport for The Texas Company, has been transferred to the Louisiana division with headquarters at New Orleans. **W. W. Moore,** from Jackson, Miss., to replace Freer at Shreveport. **Joe Gaspard,** district scout at Shreveport, La., for Sohio Petroleum Company to Lafayette, La. **Charles Curtis** to Shreveport to replace Curtis . . . **J. O. Coburn,** tool pusher for Humble Oil & Refining Company, from Galveston Bay district to Lovell Lake district. **T. O. Allen,** senior petroleum engineer, from Gulf Coast division office to Petroleum Engineering division, Houston. **J. E. Bray,** junior civil engineer, from East Texas division office at Tyler to Gulf Coast division office, Houston. **G. K. Myrhaugen,** district civil engineer, from Avery Island to Bayou Sale, La. **W. M. Satterwhite,** tool pusher, from Avery Island to Eucutta, La. **E. A. Bullington,** district civil engineer, from Bayou Sale to Louisiana division office, New Orleans. **C. C. Pyle,** assistant chief clerk, from Bayou Sale to Grand Isle, La. **W. H. Arnold,** tool pusher, from Hub, Miss., to Grand Isle, La. **N. N. Jones,** district superintendent at Gladewater, Texas, to Andrews district, West Texas division. **P. L. McGee,** assistant district superintendent at Pickton, Texas, to London district, Texas. **Rudolph W. Edmund,** geologist for Globe Oil & Refining Company, from Oklahoma City to Rock Island, Ill. **Robert L. Hoss,** engineer for Phillips Petroleum Company, from Tulsa to Tyler, Texas. **V. A. Walston,** engineer for Humble Oil & Refining Company, from Midland, Texas, to Houston. **C. M. Ross,** geologist for Amerada Petroleum Corporation, from Ardmore to El Reno, Okla. **Charles J. Delancey,** geologist, Humble Oil & Refining Company, from Houston to Los Angeles. **Harry H. Halsell,** engineer for The Texas Company, from Odessa to Goldsmith, Texas. **D. T. McCreary,** foreman at Hebbronville, Texas, to Eastland, Texas.

There's a heap of valve value packed into the Mission Manufacturing Company's 10,000 lb. capacity plug valve shown here—value that assures lowest cost in the long run because of the maker's uncompromising attitude toward quality.

And where you find this attitude you find Aetna bearings . . . find them in Mission Plug Valves, in scores of other oil country applications requiring exceptionally high load carrying capacity, precision smoothness and long, trouble-free performance under severe operating conditions. Your equipment can benefit, too, from the plus value built into Aetna bearings. Write for new catalog.

AETNA BALL AND ROLLER BEARING COMPANY • 4600 Schubert Ave., Chicago 39, Ill.

Houston Office: 704 M & M Building, Houston, Texas

Standard and Special Ball Thrust Bearings • Special Roller Bearings • Angular Contact Ball Bearings • Hardened and Ground Washers • Sleeves • Bushings. • Ball Retainers

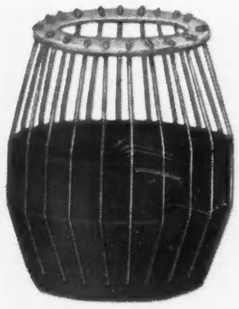
Aetna

BALL AND ROLLER BEARINGS

LIFT MORE FLUID with the BEST SWAB MADE

The Guiberson TYPE "K" SWAB with TWO TYPES of CUPS

Field men have never hesitated to acclaim the Guiberson Type "K" Swab the best in the industry—and now it is offered with *two distinct types of cups,* to do more jobs for you and do them *better.*



The STANDARD "K" CUP for the day-in, day-out job—lifts more fluid with every trip . . . for deep or shallow wells —wire basket runs at full speed past tubing gaps without loss of fluid or damage to cup.

TYPE "K" CASING SWAB WITH "K" CUPS →

TYPE "K" CASING SWAB WITH "GW" CUPS →

The NEW "GW" CUP is the perfect answer when you're swabbing in old wells . . . in mixed strings . . . in bad pipe. It's ideal for wells with low fluid level, or for taking water off of gas wells. The "GW" brings up the last cupful!

Both of these fine cups are made of a special oil-resistant compound—resilient, yet strong and long-wearing. Made in all tubing and casing sizes . . . quickly and easily interchangeable.

All Guiberson Swabs utilize the correct swabbing principle!

SAFE-T-NUT SWAB GUIBERSON BETTER BE SAFE

Reg. U. S. Pat. Off.
Established 1919

Guiberson U.S.A.

THE GUIBERSON CORPORATION

Dallas, Texas

Branch Offices in Oklahoma City and Tulsa, Okla.; Longview, Kilgore, Houston, Alice, Odessa and Wichita Falls, Texas; Lafayette, La.; Wichita, Kansas; and Newark, Ohio.

California Distributors: The W. R. Guiberson Co., 717 East Gage Avenue, Los Angeles 1
Export Offices: 30 Rockefeller Plaza, New York 20, N. Y.

© 1948, The Guiberson Corp.

DEATHS

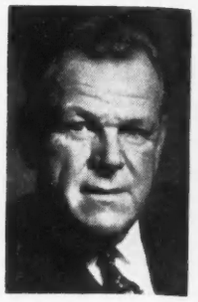
Edgar A. Holbein, 67, who retired in 1946 as a vice president and director of Standard Oil Company of New Jersey, died in Bronxville, N. Y., on August 11. Holbein joined Standard Oil Company (N. J.) as an office boy and became general manager of the Baltimore division in 1919. He was transferred to New York as domestic sales manager in 1925. In 1927 he was elected a director of Standard Oil Company of New Jersey at its formation and in 1932 he was named vice president. In 1940 he was also elected president of Standard Oil Company of Pennsylvania, now the Esso Standard Oil Company of Pennsylvania.

Edgar A. Holbein

»

M. A. Davey, 73, Texas oilman who discovered one of the first commercial producing fields in East Texas, died in Palestine, Texas, August 19. He was also successful in the Sour Lake oil field venture and participated in the development of Spindletop and Botson fields.

Harry C. Wiess, 61, chairman of the board and the last of the original organizers of Humble Oil & Refining Company, died August 26 at his home in Houston. Born in Texas, he received a civil engineering degree from Princeton University and returned to Texas to enter the oil business with companies that had been organized by his father, **Captain William Wiess.** When the Humble Company was chartered in 1917, he brought into the new organization some of the producing properties of his Paraffine and Reliance oil companies. At this time he became a vice president and director and after 1919, he devoted his full time to the Humble organization. As vice president in charge of manufacturing from 1919 to 1933, he was responsible for the company's refining and sales operations, and Baytown refinery was built under his direction. In 1933 he became executive vice president and in 1937 he was elected president. On May 10 of this year he became chairman of the board. During the war years Wiess served as a member of the Petroleum Industry War Council and the General Committee for the Southwestern Area of the PAW, as well as chairman of the Supply and Transportation Committee of District Three. In 1944 he was presented the Mid-Continent Oil and Gas Association's distinguished service award as the major oil company executive who had made the greatest contribution to the war effort that year. For many years a director of the American Petroleum Institute, Wiess was also active in civic affairs. He was vice chairman of the board of trustees of Rice Institute, a member of the corporation of the Massachusetts Institute of Technology, and a charter trustee and permanent member of the board of Princeton University. Several schools and hospitals will benefit from the provisions of his will.



Harry C. Wiess

»

W. V. Lester, 69, president of Trico Oil Company, died September 14 in Dallas. Lester, who was credited with discovering the world's greatest shallow oil pool, had been in the oil business since 1914. It was in 1926, while operating in Brown County in Central Texas that he discovered the Fry pool, which produced 44 gravity oil at a depth of 1300 feet. When the East Texas field was brought in later, he extended his operations into that section.

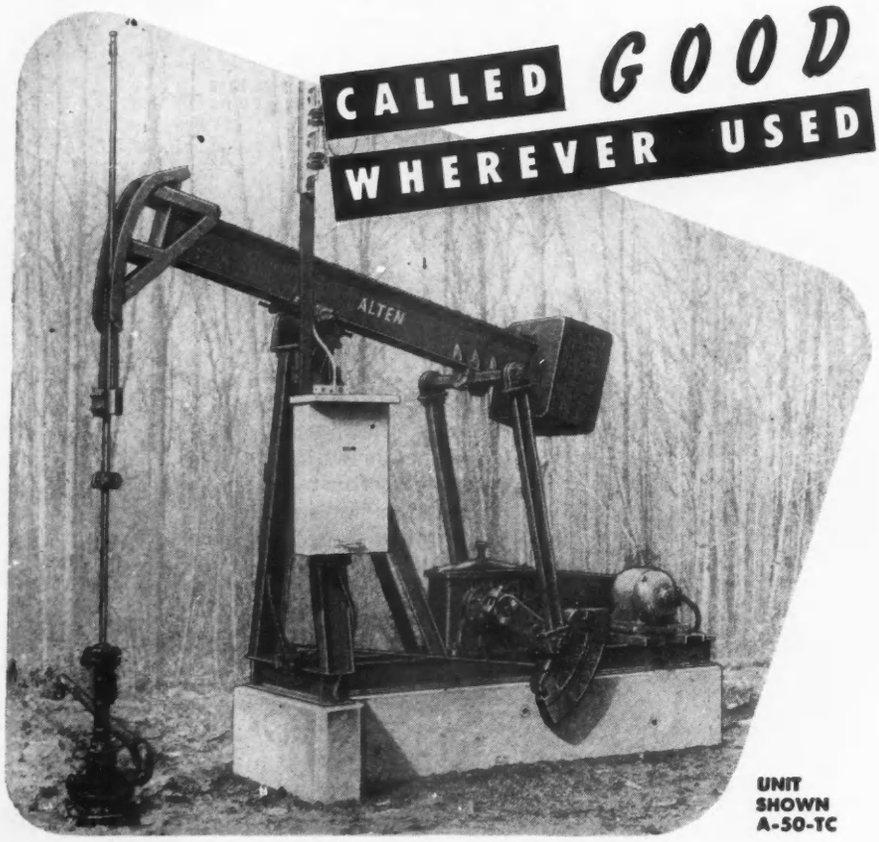
»

Harvey L. Jolly, 70, oil operator in Eastern Oklahoma, died August 15 at his home in Princeton, Ind. Jolly began oil development in the Muskogee, Okla., area where he was instrumental in opening up a number of shallow pools including the Bald Hill, Jolly-Patton, and Jolly D.L.T. pools.

»

L. A. Brauer, 64, superintendent of the Gulf Oil Company pipe line department, died in Houston on August 20. He had been associated with Gulf Oil Company for 31 years.

ALTEN UNIT PUMPERS



UNIT SHOWN A-50-TC

Quality Features Include:

★ High-Capacity Double-Reduction Gear Reducer. Chrome-Nickel Steel Pinions. Hardened Steel Gears. Helical Shaved Gearing. Roller Bearing Equipped Throughout.

★ Double-Row, Spherical Self-Aligning Wrist Pin and Equalizer Roller Bearings.

★ Rigid, All-Welded, Structural Steel Samson Post and Frame.

★ Adjustable Stroke Lengths, Effective Balancing, For Use With Gas Engine or Electric Motor.

★ High Efficiency. Weatherproof Construction.

SEND FOR NEW CATALOG

Complete Pumping Unit Specifications Also illustrates Alten Casing Heads, Stuffing Boxes, Stop Cocks and hundreds of other production items

ALTENS
FOUNDRY AND MACHINE WORKS, INC.
LANCASTER, OHIO
Established 1889
Sold Through Dealers Everywhere

DO YOU WANT POSITIVE RELIEF ?

from RELIEF VALVE MAINTENANCE

NO SEEP - NO LEAK
just set it and forget it

Employs No Stem or Seats — No Metallic Moving Parts

Grove Flexflo Pressure-loaded *RELIEVER* responds instantly to the slightest variation in line pressure—smoothly opening or closing thousands of times with no sticking, chattering, leaking or failure. Installed in parallel with code-required relief valves, Grove *RELIEVER* does away with troublesome operation and maintenance problems, when set for a slightly lower relief pressure. In other instances, Grove *RELIEVER* is fully dependable and self-sufficient for relief operation. Fully self-contained and self-operating, Grove Flexflo *RELIEVER* is equally well suited as a Back-pressure Regulator operating on constant or intermittent flow. Pressure supply is ground-insulated against temperature changes. Get full details today. Write for Bulletin 888.

- ★ *CAN'T STICK OPEN OR CLOSED*
- ★ *CAN'T BE WEDGED OPEN*
- ★ *CAN'T SLAM OR CHATTER*
- ★ *POSITIVE BUBBLE-TIGHT SHUT-OFF*
- ★ *SMOOTHLY ROLLS TO OPEN*

DOME

GROVE FLEXFLO "PUTS PRESSURE TO WORK"

PRESSURE LOADED RELIEVER

GROVE REGULATOR COMPANY • 65TH AND HOLLIS STREETS • OAKLAND 8, CALIFORNIA

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

A. C. Monteith Elected Vice President Of Westinghouse Electric Corporation

A. C. Monteith has been elected vice president in charge of engineering and research for Westinghouse Electric Corporation. He succeeds Marvin W. Smith, who has been elected executive vice president of Baldwin Locomotive Works.

Monteith joined Westinghouse in 1923 as a graduate student engineer in the training course and was assigned to the central station engineering department in 1924. He became manager of that department in 1938 and in 1941 was named manager of the industry engineering department. In 1945 he took over the dual position of manager of headquarters engineering departments and director of education.

Use Acme Cable Tools

TRUSTWORTHY SINCE 1900

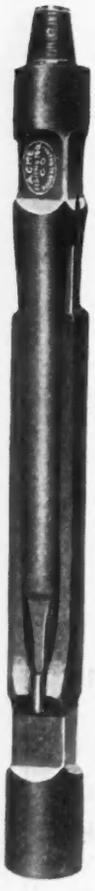


Fig. 107 Acme Rein Type Welded Jar.

IT'S THEIR LOWER COST

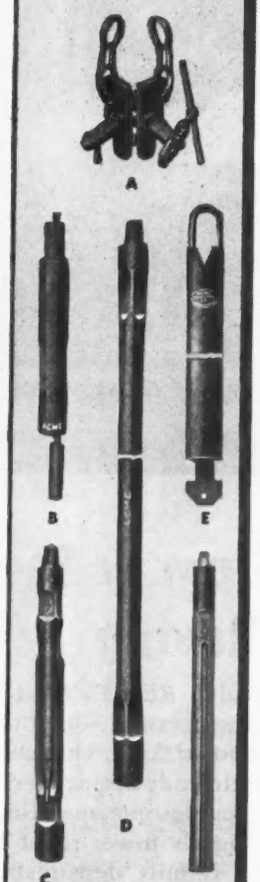
per foot of hole drilled that makes Acme Jars your MOST economical, year after year, trustworthy buy . . .

The reasons WHY: Acme's Jar and Capping steel specifications are so rigid — allowing less than a 5-point range; not the usual 10 — that the mills charge EXTRA. We accept ONLY premium-grade — for your EXTRA protection down hole. . .

Like vigilance prevails in engineering, forging, machining, inspection — throughout. Every forging's uniformity is electrically controlled — automatically shutting off at an exact, proven CORRECT point. No "burning" possible . . .

Acme Jar makers — master-craftsmen of the "Old School" — strive to maintain their unmatched "average" of flawless construction. That the demand for their product always "paces" output is a constant reminder that Acme's 48-year reputation for TRUSTWORTHY Tools is also their finest "security".

More of EVERYTHING You Need in an Acme String . . .



A—Wire Line Clamp, 12"
B—Pressor Swivel Socket
C—Drilling Jar
D—Drilling Stem
E—Bailer
F—Drilling Bit

See Acme's new Catalog insert in Composite Catalog (Vol. 1) — or write us TODAY for full information on any Cable Tool needs.

See panel (right) for other Acme Drilling Tools—for that EXTRA service you prefer.

Acme Fishing Tool Co.
PARKERSBURG, W. VA.
Export Office: 19 Rector St., New York 6, N. Y.

ACME DRILLING & FISHING TOOLS Since 1900

George McComb and Associates Form The Standard Pipe Protection, Inc.

The Standard Pipe Protection, Inc., a new firm organized to coat and wrap small diameter pipe, has purchased a 20-acre site in Brentwood, Mo., where it will construct a $500,000 plant which will contain modern coating and wrapping equipment for the protection of small diameter pipe, which will be shipped there for processing from pipe manufacturing plants throughout the country.

George B. McComb

President of the new enterprise is George B. McComb, Summit, N. J.; Hugh W. Baird, Evanston, Ill., is vice president. Both McComb and Baird formerly were associated with the Barrett division of Allied Chemical & Dye Corporation, McComb as general sales manager and Baird as regional district manager in Chicago. John B. Wilson, former executive assistant to McComb at Allied Chemical, will be secretary-treasurer of the new company.

The 70,000-square-foot plant is expected to be in operation by January 1 and initially will employ some 100 workers. Expansion plans include doubling the size of the Brentwood plant next year and the construction of two other plants in the Southwest.

The company will build a modern office building adjacent to the plant in Brentwood and will establish its national headquarters there.

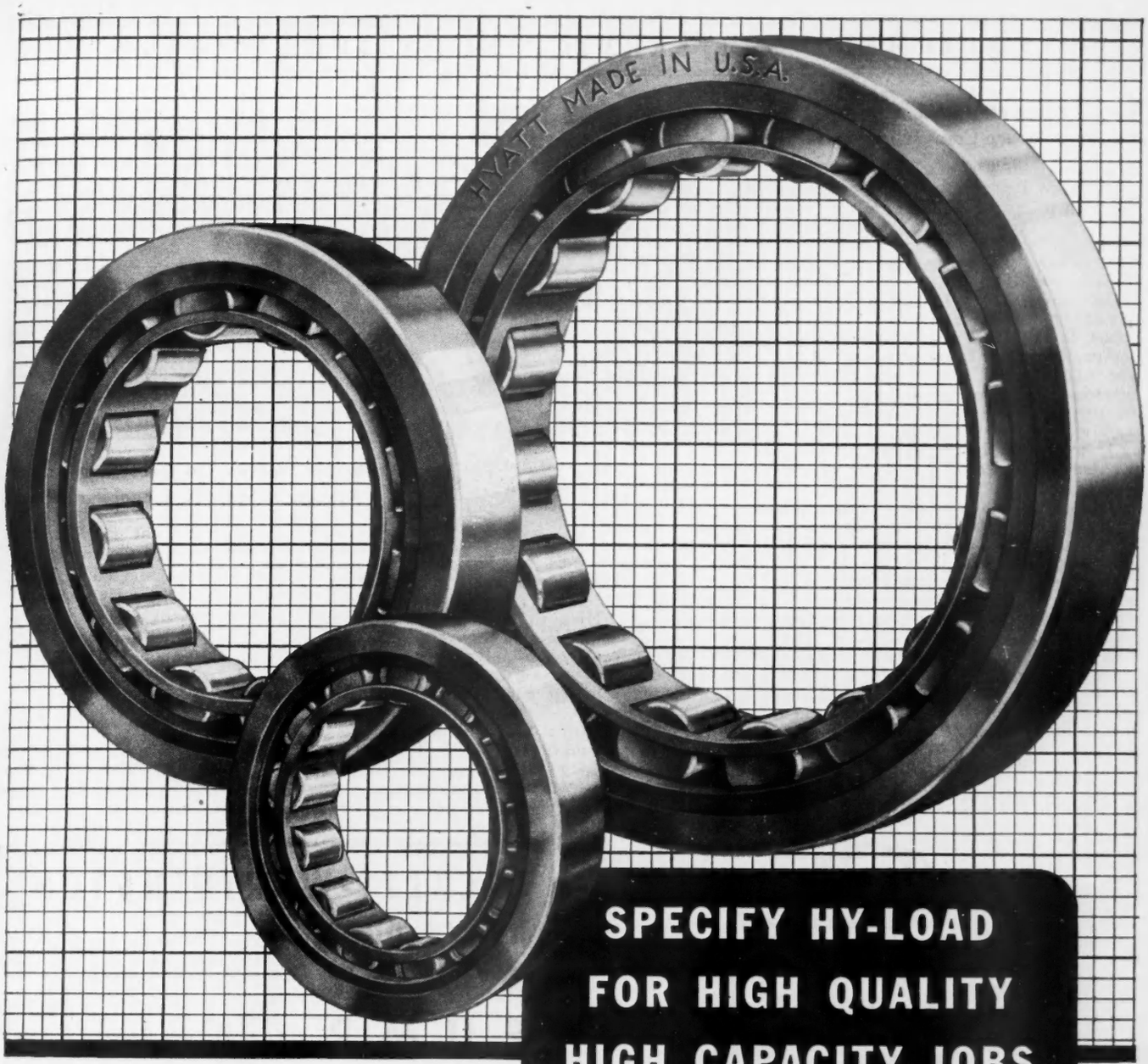
American Car and Foundry Company Appoints Assistant Vice President

Henry V. Bootes, formerly district sales manager, New York, has been appointed assistant vice president of American Car and Foundry Company. Prior to coming to ACF in 1947, he was district manager of The Ohio Injector Company, manufacturers of railroad equipment.

Henry V. Bootes

J. P. Ratigan Due to Return to U. S.

J. P. Ratigan, of Los Angeles, who has specialized in the manufacture of production equipment for 40 years, is due to return shortly from a trip to Ireland, where he visited relatives.



SPECIFY HY-LOAD FOR HIGH QUALITY HIGH CAPACITY JOBS

HY-LOAD is an outstanding member of the Hyatt Roller Bearing family. Takes on tough loads without a murmur—rough service doesn't bother it a bit.

Universally useful because HY-LOAD is made in ten types and a wide range of sizes. A high quality roller bearing for high capacity work. Separate parts are completely interchangeable; adhering to AFBMA dimensions.

HY-LOADS, for years, have demonstrated their quality and trouble-free performance in many fields—mills and factories—on farms—oil fields—railways—highways and skyways. May we help you? Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

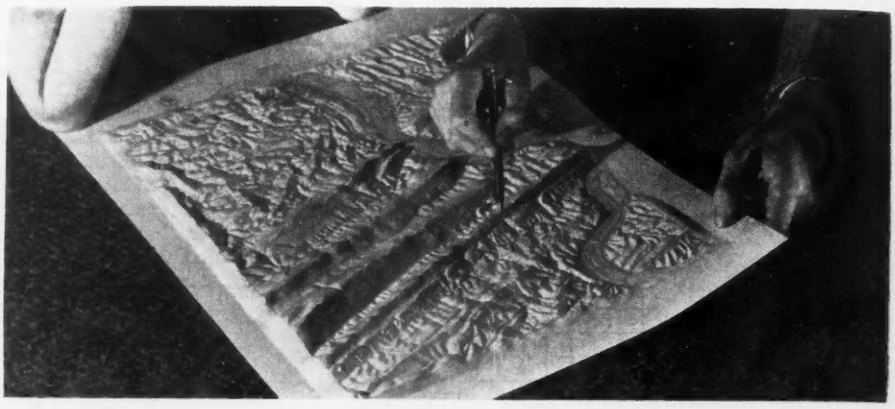
Plastic Relief Maps Win Award For Aero Service Corporation

Lightweight, low-cost molded plastic relief maps for geology and geography classes won an award for Aero Service Corporation, Philadelphia, in the Scientific classification of the seventh Modern Plastics Competition sponsored by *Modern Plastics* magazine.

Previously, most relief maps were hand-formed, hand-lettered, and colored. Often the material was heavy plaster, making the maps expensive and fragile. The plastic relief maps made by Aero Service Corporation are light in weight, inexpensive to ship, durable, and can be readily stored or displayed. A portfolio of 12 plastic maps can be bought for a fraction of the cost of a single plaster model.

In its mass-production processes, the company uses flat white vinylite sheets. The map information is lithographed on the plastic sheets in three colors. U. S. Geological Survey quadrangles are the source of the map information.

The making of the master forming model is the heart of the process. The map and contour information is transferred to a very thin aluminum sheet, which is then carefully shaped to reproduce the hills, valleys, and other finer contour details. From this formed aluminum sheet a plaster mold is made. The pre-printed flat vinylite sheets are then placed over the plaster molds in exact register. Under heat and pressure the plastic assumes the form of the mold, retaining this form when it cools. The result is a dramatic contour map in three brilliant colors.



During the war Aero Service Corporation built thousands of plastic relief maps of European and Pacific target areas. B-29 bombings of Tokyo, Yokohama, Kobe and Hiroshima were briefed from these maps. In peacetime these lightweight maps were adapted as college and secondary school teaching aids.

The company has recently completed a plastic relief map of northeastern U. S., representing land and submarine contours of the continental shelf. The company is working on several hundred foreign maps for distribution to the schools of a foreign country.

Byron Jackson Oil Tool Division Announces Sales Personnel Transfers

Robert B. Kirk of the Oil Tool division of Byron Jackson Company, Los Angeles, has been transferred from the sales training to export office, Los Angeles. John P. Kirby has been transferred from Los Angeles sales to West Texas and New Mexico sales territory; Dick T. Clardy from Los Angeles sales to West Texas and New Mexico sales territory; Harry R. Collins Jr., from sales training to Los Angeles Basin sales territory; and George D. Dwyer, Los Angeles Basin sales territory to Wyoming sales territory.

The **Igloo WATER COOLER**

"the truly Convertible Cooler"

This cooler is corrugated for greater strength and durability being of all welded construction. It is fully insulated with granulated cork to keep water colder longer. Added features include, conversion from spigot to non-spigot type, no solder joints to break out and a reinforced innerbottom.

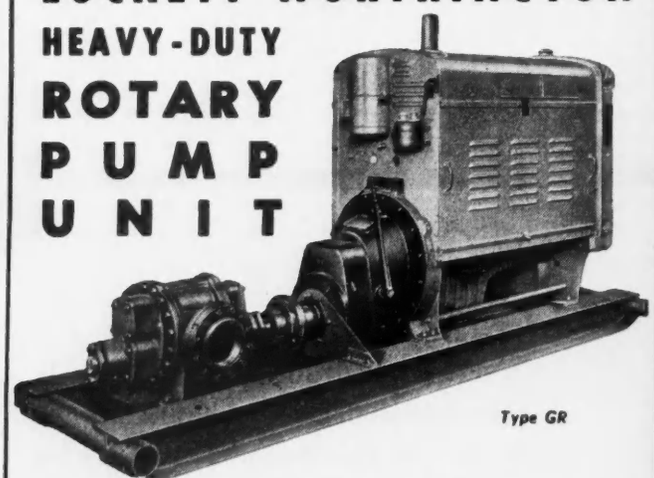
Igloo Water Coolers and Spigots Are Available at All Supply Stores

The IGLOO MANUFACTURING CO.

3809 McKinney Avenue Houston 3, Texas

LOCKETT-WORTHINGTON

HEAVY-DUTY ROTARY PUMP UNIT



Type GR

LOCKETT Dealers — from warehouses located at, or near the principal oil fields of Texas and Louisiana — can supply Worthington Pumps to meet every pumping need.

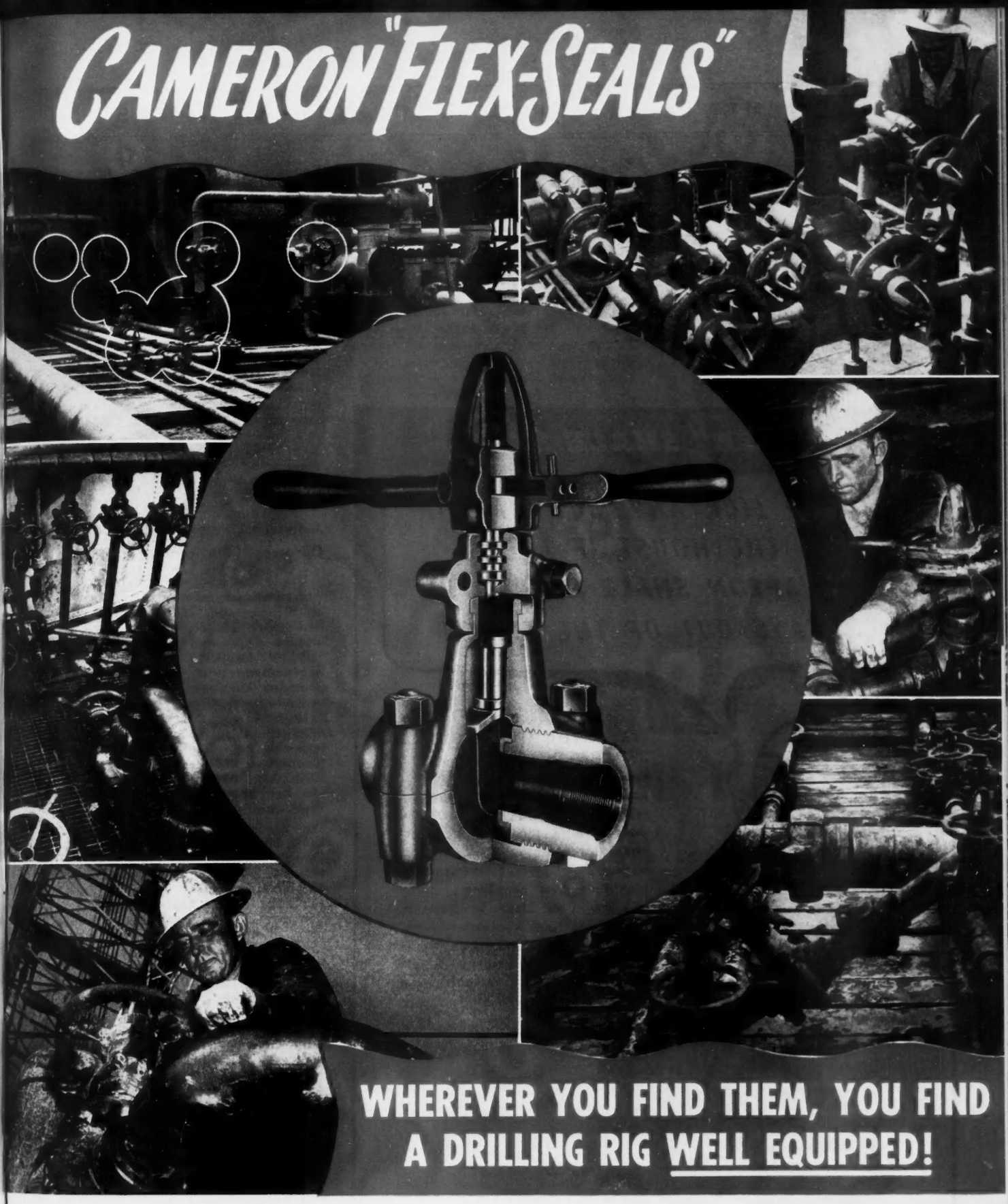
Worthington Pumps are adaptable for use with any power unit — gas, gasoline, Diesel, or electric motor of any type or manufacture.

Lockett Dealers can also promptly supply, from warehouse stock, *genuine* Worthington Repair Parts. We also carry a large replenishing stock of Worthington Pumps and *genuine* Worthington Repair Parts at our Houston and New Orleans Warehouses. For dependable, efficient service, let a Lockett Dealer supply your pump-equipment needs.

A. M. LOCKETT & COMPANY, LTD.

NEW ORLEANS HOUSTON DALLAS

CAMERON "FLEX-SEALS"



WHEREVER YOU FIND THEM, YOU FIND A DRILLING RIG WELL EQUIPPED!

Any line that handles drilling mud, or any other abrasive-laden fluid for that matter, needs the dependable, trouble-free closures that only Cameron Flex-Seal Valves can provide.

Study the cut-away view presented above and note how this valve is built to take punishment. Note that, instead of a metal-to-metal seal, the forged steel gate seats in a resilient flow-way insert which slowly absorbs the cutting action of the mud and, when finally worn out after long service, may be easily replaced at the rig with ordinary rig tools. Observe the steel wear rings which protect the hubs against abrasion, and the manner in which interlocking shoulders and grooves are utilized to attach the hubs to the valve body. This latter feature permits the valve body to swivel freely when the body bolts are loosened, thus speeding up manifolding.

Interested operators who have not experienced the economy and all-around satisfaction of Cameron Flex-Seal Mud Line Valves are invited to try a few of them on their own rigs and get a first-hand demonstration of their mechanical superiority.

CAMERON IRON WORKS, INC.

P. O. BOX 1212 HOUSTON, TEXAS

Export: 74 Trinity Place, New York, N. Y.

George D. Maves Named Manager Of Minneapolis-Honeywell Boston Area

George D. Maves has been named manager of the Boston branch of the Minneapolis-Honeywell Regulator Company, being promoted from mountain regional manager with headquarters in Denver. He will assume some of the former duties of Warren Jennings, vice president in charge of the Boston office and its sub-branches, who will be relieved of some of his more exacting responsibilities after 35 years of service with the company.

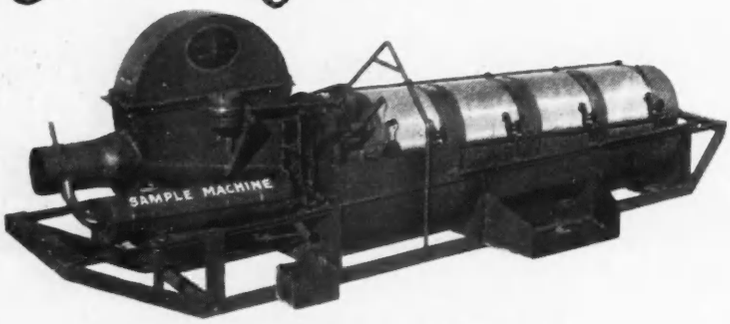
Succeeding Maves in Denver is Edwin A. Thompson, who has been promoted from the Peoria branch managership. Thompson joined Honeywell in Dallas in 1939 and was later transferred to the Kansas City office.

Robert H. Jacobs has been named Peoria manager. Jacobs joined Honeywell in 1944 and was assigned to the Milwaukee branch sales department. A graduate of Marquette University, Jacobs previously had worked for the Parker Pen Company and Standard Oil Company in Pittsburgh and Milwaukee.

"KILLER" SHALE SAYS:

I CAN LICK ANY MUDPUMP IN THE HOUSE IF THE THOMPSON SHALE SEPARATOR STAYS OUT OF THE FIGHT!

When THOMPSON SHALE SEPARATOR goes into action, you've got "Killer Shale" licked for sure. There will be less wear and tear of your drilling equipment, and your drilling mud will be thoroughly reconditioned. Self-motivating . . . perfect operation at maximum flow or idling . . . there is a model for Deep, Medium, or Shallow drilling. Accurate foot-by-foot samples of cuttings are easily obtained with the attached SAMPLE MACHINE. By-pass is standard equipment on all models.



Write Today for Free Illustrated Folder Containing Complete Data on all Thompson Separators!

THOMPSON TOOL CO.

IOWA PARK, TEXAS

KEEPS DRILLING MUD CLEAN — PROVIDES TRUE SAMPLES OF CUTTINGS

Republic Supply Company Appoints Trammell Manager Pipe Department

E. H. (Gene) Trammell has been named manager of Republic Supply Company's pipe department, with headquarters in Houston. Trammell served for more than ten years in the materials division of the Standard Oil Company of New Jersey in South America. During the past ten years he has been engaged as export representative in New York for several leading oil equipment manufacturers.

E. H. Trammell

American Locomotive Company Plant Observes 100th Anniversary

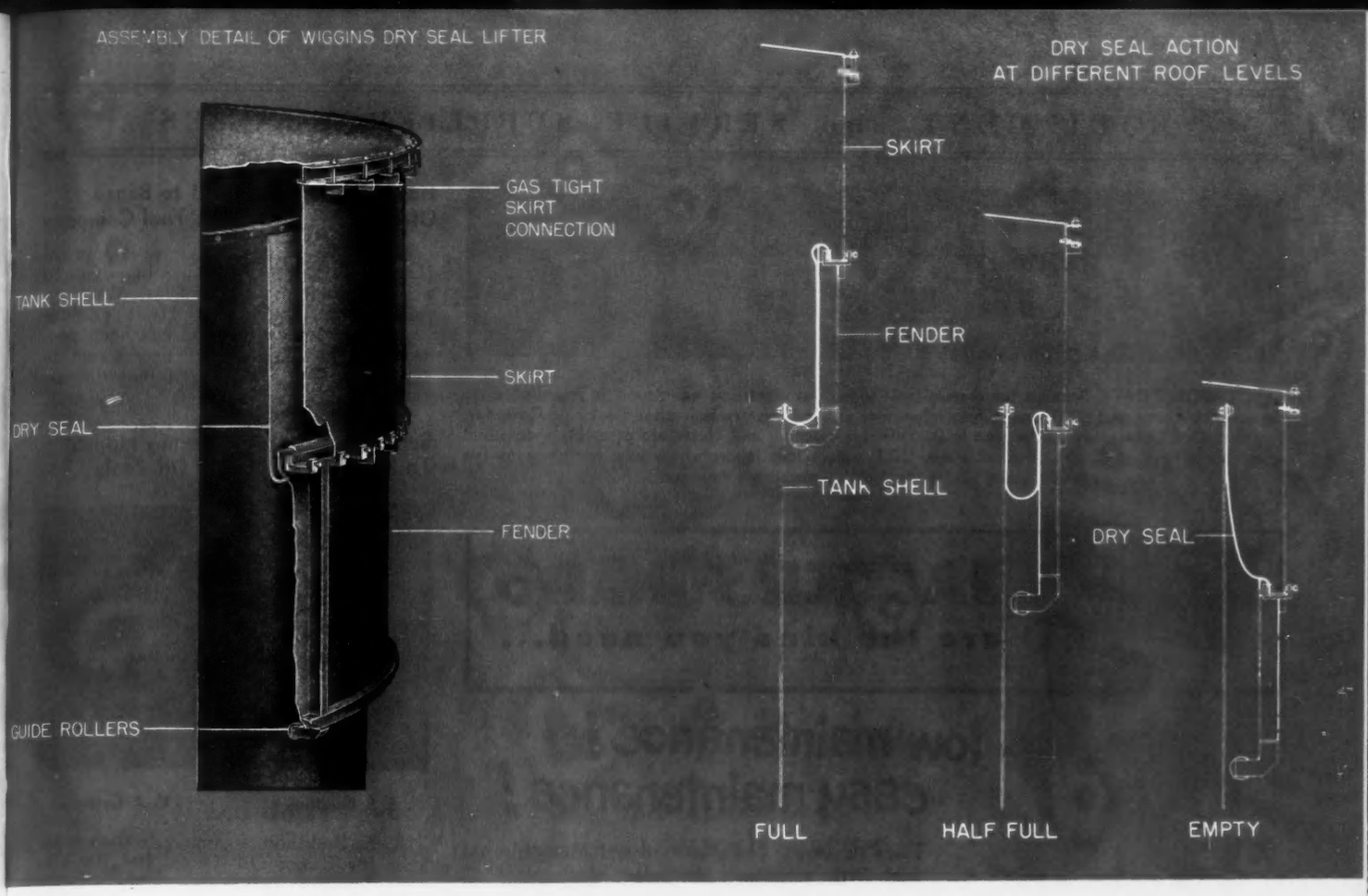
The hundredth anniversary of the American Locomotive Company plant at Schenectady, N. Y., was observed September 24, 25, and 26, with ceremonies which included dedication of a 110-foot flagpole to the memory of Schenectady war dead on behalf of company employes, erection of a commemorative plaque from the people of Schenectady at American Locomotive's new general office building, and a dinner honoring completion of 50 years in the locomotive industry by Robert B. McColl, Alco president. Open house was also held at the Alco plant for employes, their families, and the public.

Organized in 1848 by a group of men headed by John Ellis, Platt Potter, and Daniel D. Campbell, the company was first named Schenectady Locomotive Engine Manufactory and in 1851 became the Schenectady Locomotive Works. The first locomotive rolled out of the plant about a year after the first meetings and by 1854 the company was producing 37 engines a year.

After the Civil War, during which the company built a large number of locomotives for government use, the company expanded and in 1880 began to build heavier locomotives under the leadership of Albert J. Pitkin. The output of the company grew steadily to 417 locomotives in 1900 and in 1901 the Schenectady Locomotive Works became the backbone of today's American Locomotive Company.

The Schenectady plant continued to grow after its alliance with seven other companies and by 1907 was producing 942 locomotives a year. When World War I came, it supplied the government with a large number of locomotives, as it did again in World War II, when it also manufactured tanks.

American Locomotive Company has been responsible for many firsts in the locomotive industry and was especially instrumental in the development of diesel-electric locomotives. Its vast 112-acre installation has recently been converted 100 percent to the manufacture of diesel-electric locomotives.



IMPORTANT EXCLUSIVE FEATURES OF A WIGGINS LIFTER ROOF

Page 13 of the new "Wiggins Vapor Balancing Systems" booklet illustrates and describes the Skirt, the Fender and the Dry Seal — very important design and construction features for the efficient performance of lifter roofs.

Illustrated and described in the same book are exclusive design and construction features of the Wiggins Dry Seal Gasholder.

Copies of this new booklet are now available—executives and engineers responsible for storing products subject to evaporation losses will find the information in this book invaluable. Write for your copy today.

WIGGINS CONSERVATION STRUCTURES

- Hidek Floating Roofs
- Lodek Floating Roofs
- Balloon Roofs
- Breather Roofs
- Dry Seal Lifter Roofs
- Dry Seal Gasholders

WIGGINS VAPOR SEALS
GENERAL AMERICAN
TRADE MARK

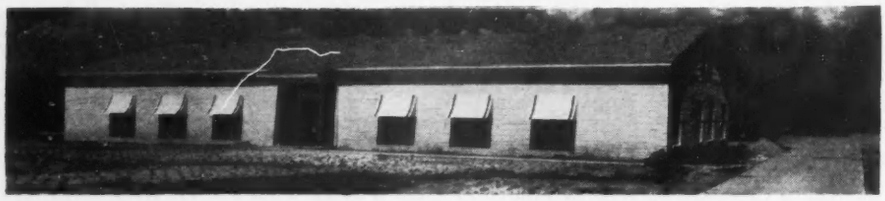
GENERAL AMERICAN TRANSPORTATION CORPORATION

135 SOUTH LA SALLE STREET, CHICAGO 90, ILLINOIS

BRANCH OFFICES: New York • Washington, D. C. • Cleveland • Buffalo • Pittsburgh • St. Louis
New Orleans • Tulsa • Dallas • Houston • Seattle • Los Angeles • San Francisco

Sub-licensees

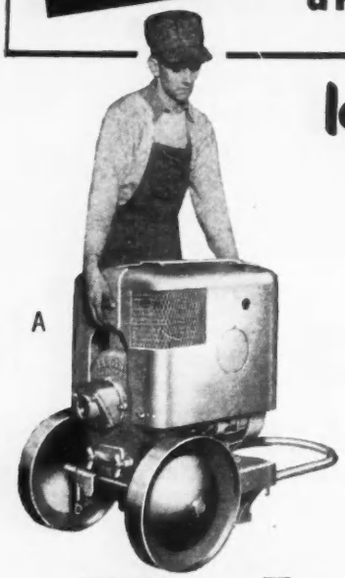
WESTERN STATES: Consolidated Steel Corp.—Western Pipe & Steel Co. of California, Los Angeles—San Francisco • CANADA: Toronto Iron Works, Ltd. Toronto
SOUTHERN STATES: Wyatt Metal and Boiler Works, Houston — Dallas, Texas • GREAT BRITAIN: Motherwell Bridge & Engineering Co., Ltd., Scotland
FRANCE: Etablissements Delattre & Frouard réunis, Paris



NEW LABORATORY—Demand for custom-built industrial electronic equipment is responsible for the recently-completed 5000-square-foot laboratory of Southwestern Industrial Electronic Company. The Post Oak Laboratory in Houston houses offices, machine and electronic assembly shops, and testing laboratories. Construction of a new 5000-square-foot laboratory is now underway at the present plant site to double the company's facilities.

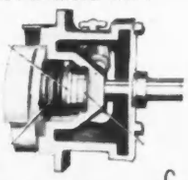
another reason why

JAEGER PUMPS
are the kind you need...



low maintenance! easy maintenance!

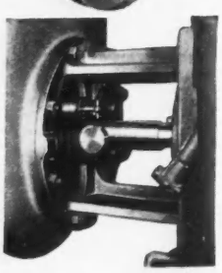
They're built for heavy-duty pumping with little attention. Impeller blades will even handle stones from 1" to 2½", depending on pump size. Power units bolt directly to pump shells (B)—positively, permanently aligned. Shafts of sizes from 4" up have extra, massive center support bearing (B). Patented "Lubri-Seal" seals shafts against pressure or vacuum losses for long periods (C).



C

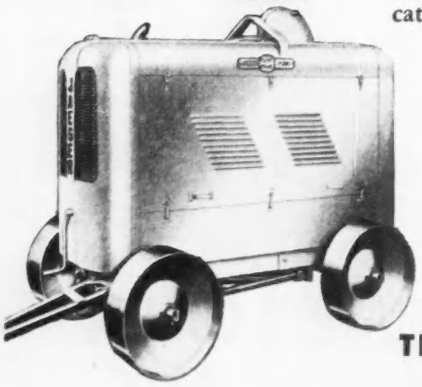
D

A



B

And, normal maintenance is easy. Hoods remove for complete access to pump and engine (A). Lubri-Seal is instantly inspected. Hardened steel liner plates easily remove and replace by merely loosening two bolts (D). In all, they're field men's pumps — require little maintenance and make that maintenance easy! Write for catalog PF8.



APPLICATIONS
Drill Rig Water Supply • Tank Transfer
Jetting • Dewatering Pipe Lines
Mud Transfer • Pumping Tank Bottoms
General Dewatering

SIZES
1½ to 10 inches • 3,000 to 240,000 gph

TYPES
Engine and Motor-Driven
Lightweight • Heavy Duty • Jetting
High Pressure • Lift & Force Diaphragm

THE JAEGER MACHINE CO.
FACTORY — Columbus 16, Ohio

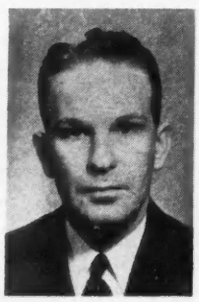
REGIONAL OFFICES: 1504 Widener Building, Philadelphia 7, Pa.
226 N. La Salle St., Chicago 1, Ill., 235 American Life Building, Birmingham 1, Ala.

Distributors in 130 Cities in the U. S. and Canada.

Harry E. Rogers Named to Board Of Directors of Hughes Tool Company

Harry E. Rogers, vice president of Hughes Tool Company, has been named a member of the board of directors. Rogers has been with Hughes since 1945, since which time he has been promoted from manager of production to vice president in charge of manufacturing.

Bedillion, Greve, and Ramby Named To New Posts by Baker Oil Tools



R. S. Bedillion

C. A. Greve

R. S. Bedillion, formerly branch manager for Baker Oil Tools, Inc., in Victoria, has been transferred to Odessa as branch manager. C. A. Greve, formerly staff assistant at Houston, has been transferred to Victoria as branch manager. R. L. Ramby, formerly sales and service engineer in Corpus Christi, has been promoted to branch manager with headquarters in Corpus Christi.

R. L. Ramby

R. D. McBrian, formerly West Texas district manager in Odessa, has been transferred to Central division headquarters in Houston as assistant manager of district sales and service. C. C. Taylor, former branch manager in Odessa, replaces McBrian.

Culp Engineering Company Occupies New Plant Facilities in Houston

Occupying new plant facilities in Houston is the recently-organized Culp Engineering Company, which offers a complete valve repair service. The firm has exclusive license on the application of the Culp lapping machine.

Officers of the new company are T. C. Billups, president; M. J. Conley, vice president; and H. J. Wilder, secretary-treasurer.

Carl Hochenauer Elected President And Treasurer of Texoma Supply

Carl J. Hochenauer has been elected president and treasurer of the Texoma Supply Company, Tulsa. Other officers chosen include James M. Cleary, executive vice president; Ray H. Smith, vice president in charge of sales; and Warren A. Read, secretary.

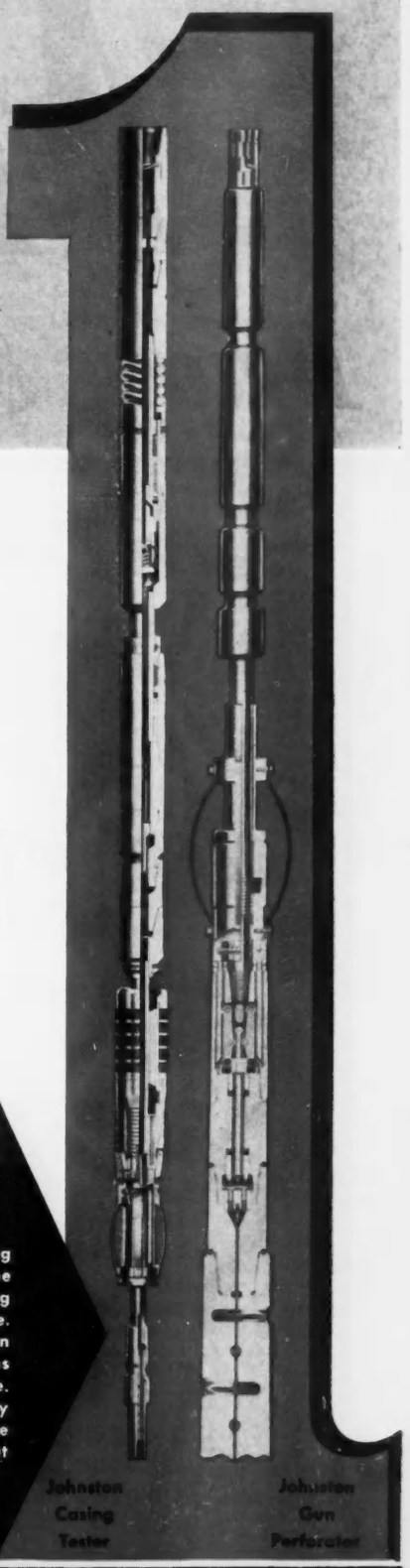
PERFORATE...
TEST...
ACIDIZE...
and TEST again...

JOHNSTON DOES IT
all in ONE trip...

You don't spend a lot of time and money yo-yoing drill pipe when you use Johnston's SHOOT-N-TEST service because you can perforate . . . and test . . . and acidize, if required . . . and test again without ever coming out of the hole.

This combination . . . the Johnston Hydrostatically Actuated Gun Perforator and Johnston Casing Tester . . . cuts many hours off completion time . . . saves wear and tear on equipment . . . gets your wells on production faster.

For complete information about this faster, safer, know-what-you're-doing completion method, contact your nearest Johnston representative.



ACIDIZING THROUGH THE JOHNSTON TESTING TOOL

If results obtained on a Johnston Casing Test indicate a necessity for acidizing, the job can be done effectively without pulling the pipe and Testing Tool from the hole. After acidizing, the formation can again be tested and the procedures repeated as often as required without once pulling pipe. Where necessary to break down extremely tight formations, high pressures can be applied through the Testing Tool without damage.

JOHNSTON OIL FIELD SERVICE CORPORATION
5702 Navigation Blvd., Houston, Texas
"SERVICING MID-CONTINENT AND GULF COAST AREAS"
Cisco, Alice, Tyler, Victoria, Wichita Falls, Graham, Throckmorton, Texas; Lake Charles, Shreveport, Louisiana; Magnolia, Arkansas; Laurel, Natchez, Mississippi; Chickasha, Oklahoma; New Harmony, Indiana; Fairfield, Illinois.

M. O. JOHNSTON OIL FIELD SERVICE CORPORATION
3035 Andrita Street, Los Angeles 41, California
"SERVICING CALIFORNIA—PERMIAN BASIN—ROCKY MOUNTAIN AREAS"
Bakersfield, Avenal, Sacramento, Ventura, Santa Maria, Calif.; Odessa, San Angelo, Texas; Casper, Wyo.; Hobbs, N. M.

M. O. JOHNSTON OIL FIELD SERVICE COMPANY
"EXCLUSIVE EXPORT SALES"
3035 Andrita Street, Los Angeles 41, California

FORMATION AND CASING TESTING
JOHNSTON

More Briggs & Stratton Air-Cooled Engines than ever before

Our capacity to produce Briggs & Stratton 4-cycle, air-cooled, gasoline engines is now at an all-time high.

More gasoline-powered machinery, appliances and equipment are being powered by Briggs & Stratton engines than ever before.

BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wisconsin, U. S. A.

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES
World Wide FACTORY SUPERVISED SERVICE

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Mont Land Elected Vice President Of Petrolite Corporation of America

Mont Land, former South American representative of Petrolite Corporation of America, Ltd., has been elected vice president. He will have charge of the firm's activities in South America and will have headquarters at Caracas. Land joined Tretolite Company, companion firm, in 1937 and held various positions throughout the Mid-Continent area.

E. E. Hedene Named Chief Engineer Of Rockwell Nordstrom Valve Division

E. E. Hedene has been named chief engineer of all operations of the Nordstrom Valve Division of Rockwell Manufacturing Company. He was formerly the chief engineer of the Nordstrom valve plant at Oakland, Calif., where for the major part of his 22 years service he worked directly with Sven Nordstrom, the inventor and developer of the lubricated plug valve.

E. E. Hedene

Hedene will be headquartered at the company's general office at Pittsburgh. His duties will include considerable field work in addition to coordinating the Nordstrom engineering activities at the Pittsburgh, Hopewell, Oakland, and East Chicago plants. Hedene studied mechanical engineering at the University of California and was affiliated with several West Coast engineering firms before coming to Nordstrom.

G. W. Sinclair Named Chief Engineer For Johnston Hydra-Line Division

George W. Sinclair has joined the Hydra-Line division of Johnston Enterprises as chief engineer. R. B. Luirette has been named chief of quality control for the organization, and Carl H. Englemohr has been named sales engineering manager.

Sinclair was formerly engineer for the Reed Roller Bit Company and chief engineer and shop superintendent for the Chester T. Allen Core Drilling Company in Bakersfield, Calif. During the war years he was associated with the Willys-Overland Company and then managed his own firm of consultant engineers, until he joined Johnston Enterprises.

Luirette was former project engineer for International Derrick & Equipment Company. Englemohr was also formerly employed by International Derrick & Equipment Company and by the Carnegie-Illinois Steel Corporation in Chicago.

Store Opened in Houma, Louisiana, By Wilson Supply Company of Houston

The Wilson Supply Company of Houston has opened a store in Houma, La. W. C. Johnson is manager of the new store. H. E. Jordan is assistant store manager, with Charles Tuminello, field salesman, and Frank Anders, warehouseman.

Four Wheel Drive Auto Company Makes Engineering Division Changes

Donald B. Olen, formerly chairman of the manufacturing committee of The Four Wheel Drive Auto Company, has been named director of the engineering division, and H. B. Dodge, former director, has been elevated to technical advisor to the management of the company. G. D. Simonds, formerly manager of design engineering has been named chief engineer in charge of design of standard models.

Donald B. Olen

B. G. Donley is manager of development engineering, concentrating his efforts on specialized products. James A. Sorenson, metallurgist for the company for more than 30 years, has had added to his responsibilities those of research engineer.

Gurasich Appointed District Manager For Sperry-Sun Well Surveying Firm

Steve W. Gurasich, former district manager for Sperry-Sun Well Surveying Company at Long Beach, Calif., has been transferred to Philadelphia to engage in development work.

Harry M. Lowe, formerly district representative in Bakersfield Calif., has been moved to Long Beach, where he is acting in the capacity of California district manager.

Karl C. Clark has been assigned the position of district representative at Bakersfield. A. E. Lemke has been added to the sales and service force in the Long Beach office.

J. B. Peddy has been transferred from the sales and service department at Houston to Oklahoma City, where he is acting as district manager. He is assisted by O. C. Wright and R. D. Warden, sales and service engineers.

B. W. Morgan has taken over the managership of the Lafayette, La., district, where he has worked for some time as a sales and service engineer. Morgan is assisted by Robert L. Perkins, sales and service engineer

Parker F. Wilson Elected President Of Kerotest Manufacturing Company

Parker F. Wilson, has been elected president and director of the Kerotest Manufacturing Company. Former president Walter G. Swaney was named vice chairman of the board.

Parker F. Wilson

Wilson has served in various executive capacities with Otis Steel Company, Wheeling Steel Corporation, and more recently as president of Pittsburgh Steel Foundry Corporation.

Fluid Packed Pump Company Names Glen Peters Assistant Sales Manager

Glen Peters has been made assistant sales manager for Fluid Packed Pump Company in the Mid-Continent, Gulf Coast, Rocky Mountain, and Eastern area with headquarters at Oklahoma City. Peters is a veteran oil man who has been with the company since 1941.

Jack Hampton, formerly a California salesman for Fluid Packed Pump Company, has re-entered the company's employ and been made factory representative for Mississippi with headquarters at Laurel.

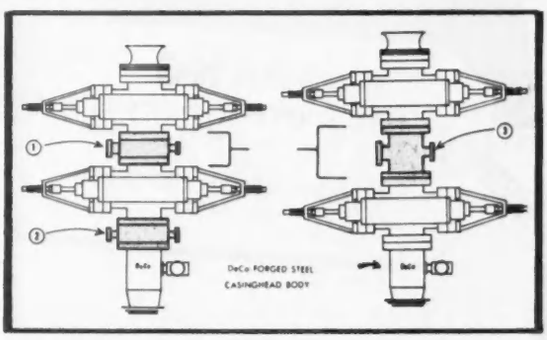
Charles Cameron, pump salesman in California, Montana, and Oklahoma, has been appointed Arkansas factory representative with headquarters at Eldorado.

Edward Platz Named Sales Manager

Edward H. Platz, Jr., has been named sales manager of the Alloy division of Lebanon Steel Foundry.

ARE YOU CRAMPED FOR CELLAR SPACE?

Then you'll be interested in the new DeCo Forged Steel, double studded adapter with elliptical openings.



The arrangements at the left show a comparison between the DeCo elliptical outlet adapter, type D S F, and the DeCo spool adapter, type D F F O. The arrangement on the left utilizes two adapters in less cellar space than is used with one spool type adapter on the right.

1. DeCo double studded adapter, type D S F, series 900 with elliptical outlets. OVERALL HEIGHT 9 INCHES, 6 inches flow line, 3 inches fill up line.
2. DeCo double studded adapter, type D S F, series 900, with elliptical outlets. OVERALL HEIGHT 6 INCHES. 3 inches flow line and fill up line.
3. DeCo open flange spool adapter, type D F F O, series 900. OVERALL HEIGHT 22 INCHES. 6 inch flow line, 3 inch fill up line.

DeCo THE DeLANEY CO. HOUSTON·9·TEXAS

6119 E. Montgomery Rd.

DeCo oil field equipment sold through leading supply stores.

Steel Fabricating—DeCo Forged Steel Well Head Equipment—DeCo Power Slips—Forgings

Eastman Oil Well Survey Company Transfers Stokenbury and Armell

Clyde I. Stokenbury, manager of the Eastman Oil Well Survey Company, Dallas office, has been made district manager of the Bakersfield, Calif., office, a position he held prior to the Dallas assignment. The Dallas office has been combined with the company's expanded Oklahoma City district.

Roland Armell, former manager of the Bakersfield district, has been made assistant to Ross E. Wiley, Pacific Coast division manager, at Long Beach. Wm. D. Compton, formerly of Eastman's Long Beach division, has been promoted to general field manager of the Eastman organization and transferred to the general offices in Denver.

Don E. Woodward, of Eastman's Houston office, will be placed in charge of an office to open soon in Abilene, Texas.

Clyde Stokenbury

Roland Armell

Spang Slip and Combination Sockets are rugged and tough. Room in the hole to add mass is limited, so Spang has substituted steel quality and heat treatment to give that extra strength needed to stand long heavy jarring when it is necessary.

They are carefully forged, thoroughly heat treated, and accurately machined. You can count on them!

Even a soft, simple fishing job can get tough and complicated. That's why it pays to always use only the best fishing tools for any fishing job. For the best in Cable Tools, SPECIFY SPANG.

SPANG & CO.
BUTLER, PA.

YOUR DEALER SELLS SPANG TOOLS

Emsco Names Assistant Manager Of California and Export Sales

Vaughn A. Euge has been appointed assistant manager of California and export sales for Emsco Derrick & Equipment Company. Euge has been with Emsco since 1933, starting in the shop and advancing via production control, warehouse, material control, and sales order to his present position. He attended Loyola University, where he graduated with a Bachelor of Science degree, majoring in commerce and finance.

Vaughn A. Euge

C. H. Dickens Named Chief Chemist For Universal Atlas Cement at Waco

Charles H. Dickens, chief chemist and inspector at Universal Atlas Cement Company's Waco plant, was appointed assistant plant manager. Harry W. Hunt, assistant chief chemist, was appointed to succeed Dickens as chief chemist and inspector.

Dickens has been chief chemist at the Waco plant for the past 19 years. He joined the company in 1922 at its Independence, Kansas, plant, serving there as laboratory assistant and assistant chemist until April, 1929, when he was transferred to the Texas plant as chief chemist.

Hunt has worked continuously at the Waco plant for 20 years. Beginning as a laborer there in September, 1928, he was made an analyst in 1940 and was appointed assistant chief chemist in 1947.

Worthington Corporation Names Ellis Assistant Merchandising Manager

Frederick J. Ellis has been appointed assistant merchandising manager, pump and compressor sales, for Worthington Pump and Machinery Corporation. He will have charge of the distribution of standard pumps and compressors through oil field distributors.

Ellis, who joined Worthington in 1916, was formerly assistant manager of reciprocating pumps sales divisions.

Frederick J. Ellis

HELP WANTED

Major oil company desires experienced Seismic Interpreter preferably with Party Chief experience. Permanent location in Division Office, Ft. Worth, Texas. Salary open. Address: Box 80w c/o World Oil, Houston, Texas.

■ CHIEF PETROLEUM ENGINEER: Attractive position open for a young man with five to ten years experience in oil production at a responsible level. Capable of originating decisions and exercising own judgment on matters of technical and responsible matters. A graduate in Petroleum Engineering, Mechanical Engineering, or Chemical Engineering. Good appearance and plenty of executive ability. Salary $10,000. All replies confidential. Write full details to:

Chas. J. Loveless, Personnel Service, 508 Mayo Building Tulsa, Okla.

SITUATIONS WANTED

■ Seismograph supervisor; Geol. Engr. degree; eight years experience. Address: Box 79W, c/o World Oil, Houston, Texas.

LEASES, DRILLING, ACREAGE, ETC.

■ SEE A. L. BOWLES, ADA, OKLAHOMA, FOR SHALLOW DRILLING DEALS IN OKLAHOMA.

■ We will buy producing or non-producing oil royalties. Send particulars. Standard Security Co. 115 Broadway, New York 6.

PROFIT BY BUYING

ROYALTIES WHERE

THE PLAY IS HOT

AND PRICES LOW!

The Rocky Mountain area is seething and one of the hottest spots is east of the Rockies in Montana, southeast of Gulf's major strike near Glacier Park. The big companies are pouring in and the time to buy royalties is NOW—ahead of production. That is when the real profits are made. This firm is in its 25th year and specializes in AHEAD-OF-THE-DRILL royalties, in major company blocks. WRITE US TODAY! Landowners Royalties Company, Great Falls, Montana.

REAL ESTATE

BUSINESS AND RESIDENCE

For sale or lease six room office or combination office and residence 50' x 50' shop or warehouse. Located on lot 150' x 200', 1 block off Wayside Drive, 2914 Pitzlin Street, Houston, Texas. Phone Woodcrest 6-6389.

WANTED TO BUY

■ Wanted: Good used Cardwell combination, capacity about 4000 feet rotary drilling. Also good used cable outfit capacity 2500 feet six inch hole. Address: Box 80-W, c/o World Oil, Houston, Texas.

WANTED
96' OR 97' LEE C. MOORE
CANTILEVER MAST.

B. & B. DRILLING CO.
Post Office Box 309. Telephone 706
Pauls Valley, Oklahoma

NEW CLOSING DATE for The Trading Post

Effective with the October issue, advertisements in The Trading Post section of WORLD OIL must be received by the publisher on or before the 5th of the month preceding date of issue.

New Books

Petroleum Geology Review

"Review of Petroleum Geology in 1947" is the sixth such annual review published in cooperation with the American Association of Petroleum Geologists. Authors include F. M. Van Tuyl, W. S. Levings, and L. W. LeRoy of the department of geology, with contributions by members of the faculty of the departments of geology and geophysics, and petroleum engineering. American and foreign geologists, geophysicists, and petroleum engineers have also contributed to the review which is based on information compiled from literature and from a canvass of leaders in petroleum exploration in the U. S. and other countries.

The publication comprises 334 pages, a bibliography of about 3500 listings and covers the more important events of 1947; advances in petroleum geology and contributory fields including developments in the training of geologists and geophysicists, progress in the developments of geophysics and geochemistry, developments in petroleum engineering, aerial photographs, new and improved techniques, world exploration and development, production and reserves, trends in petroleum geology and geophysics, and the future of the petroleum industry.

Department of Publications, Colorado School of Mines, Golden, Colo., $3 postpaid.

Stratigraphic Section

Bulletin No. 55 of the Tennessee Department of Conservation, Division of Geology, is entitled "Stratigraphic Section at Lee Valley, Hawkins County, Tennessee," by John Rodgers and Deane F. Kent.

Tennessee is one of the largest producers of zinc ores in the eastern United States. Practically all of this zinc is derived from the Knox group, a section of dolomite and limestone whose thickness in the area of this report is about 2600 feet. It has been found that the accumulation of commercial bodies of ore is definitely related to details of stratigraphy and structure.

In order to map these details of stratigraphy, a good working knowledge of the section is necessary. A number of more or less obscure marker beds are present and must be traced in the process of mapping. This report describes in detail the excellently exposed section of the Knox at Lee Valley and compares it with a similar section at Thorn Hill. This comparison brings out the persistency of several of the marker beds and for this reason should expedite the work of geologists and lead to a fuller understanding of the Knox group.

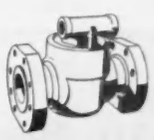
Tennessee Division of Geology, G-5 State Office Building, Nashville. Sixty cents.

TANNER
HIGH PRESSURE
VALVES

LAST LONGER

Because of the extreme ease of operation and the entire elimination of lubrication and plug adjustment, the possibility of allowing the valve to remain in a position other than fully opened or fully closed is greatly reduced — thereby reducing the possibility of cutting the seats and plug.

These valves are used in DRILLING, CEMENTING and PRODUCING. Available in either flanged or screwed ends. Valve sizes range from 1" to 4". Write for our catalog for complete details.



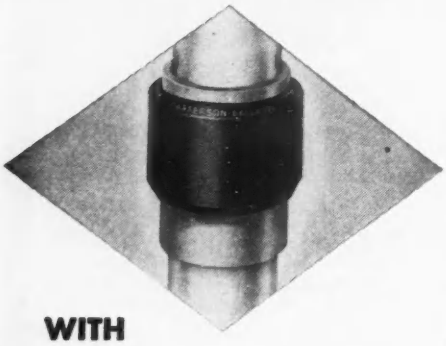
C. L. TANNER CO.
6887 Farmdale Avenue
North Hollywood, California

YOU CAN

Stop these Losses

AND

Save Your Casing



WITH

PATTERSON-BALLAGH

Plastic Tubing Protectors

Tubing collars worn by contact with casing steal the profits out of pumping. Patterson-Ballagh Plastic Tubing Protectors prevent both collar and casing wear. Oilproof, wear resistant—these protectors are securely bonded to standard size tubing collars at the factory.

See Composite Catalog for more details and *end* your tubing troubles by installing Patterson-Ballagh Plastic Tubing Protectors.

Specify PROTECTION PROVEN

PATTERSON-BALLAGH

DIVISION OF BYRON-JACKSON CO.

PLASTIC TUBING PROTECTORS

Main Office: P. O. Box 2493, Terminal Annex, Los Angeles 54

Offices:
HOUSTON • SAN FRANCISCO
NEW YORK • LONDON • BUENOS AIRES

The Return

The woman applying for relief told the social worker her husband had deserted her ten years before. Upon inquiry, the worker found that the woman had seven children, ranging in age from a few months to nine years.

"But," she said, "how about all these small children—I thought you said your husband deserted you ten years ago!"

"Oh, he did. But you see, he sneaks back once in a while at night to apologize."

Prove It

Mike: "You say Helen is a Russian? How do you know?"

Joe: "Always making advances, always making advances."

Surprise!

"What are you sticking in your vest pocket there, Murphy?"

"That's a stick of dynamite. Every time that big Riley sees me, he slaps me on the chest and breaks all of my cigars. The next time he does it, he's going to blow his hand off."

None of That Stuff

Sarge: "I suppose when the war's over, you'll be waiting for me to die so you can spit on my grave."

Wretched rookie: "No, Sarge. After the war is over, I never want to stand in line again."

Emergency

Golfer (to members ahead): "Pardon, but would you mind if I played through? I just heard that my wife has been taken seriously ill."

Determined

An inmate of the lunatic asylum was to be examined for dismissal. The first question was: "What are you going to do when you get out of here?"

The inmate replied: "I'm going to get me a sling shot and come back and break every damn window in this place."

After another six months in the padded cell, he was again examined. The same question was put to him.

"Well, I'm going to get me a job," was the reply.

"Fine," said the examiner. "And then what?"

"Then I'm going to buy a big car."

"Good."

"And then I'm going to meet a beautiful girl."

"That's wonderful."

"Then, I'm going to take her out driving on a lonely road."

"Yes."

"And I'm going to put my arm around the girl."

"Yes."

"And then I'm going to grab her garter, make a sling shot, and come back here and break every damn window in the place."

"One pint of fluid and check the flint, please."

PETROLEUM ENGINEERS
CABLE & STINE
WICHITA FALLS, TEXAS

EXPERIENCED PRACTICAL AND TECHNICAL CONSULTING PRODUCTION ENGINEERING SERVICE

•

SPECIALIZING in MODERN SECONDARY RECOVERY

ESTABLISHED 1916
The OIL WEEKLY
EAST ENGINEERING LIBRARY

Table of Contents page 43
Advertisers' Index page 40

NOV 5 1948

WORLD OIL

SPECIALIZED FOR DRILLING, PRODUCING, PIPE LINE OPERATIONS AND MANAGEMENT

Subscription Price, $2 Per Year — NOVEMBER, 1948 — Price This Copy, 50 Cents

GOING PLACES *together!*

Each basic industry still has a big job to do—and petroleum is in the forefront of the drive. Keep your drilling, pipe-laying and refinery operations rolling with the aid of *Preformed* Yellow Strand. It's the flexible rotary line that handles round trips faster. The smooth-running casing line that resists kinking. The winch or hoist line that spools evenly and curtails drum-crushing. To get going and *stay* going, specify long-lived *Preformed* Yellow Strand.

Broderick & Bascom Rope Co., St. Louis
Houston Branch: 1311 Palmer St.

BRODERICK & BASCOM
Yellow Strand
PREFORMED ROTARY LINE

The Continental Supply Co.
Mid-Continent Distributors
Stores Located in All Active Fields

The Republic Supply Co.
of California
Oil Field Distributors for California

The McJunkin Supply Co.
Charleston, West Virginia

CAMERON FLOW-WINGS

make choke changing as simple as ABC

A *Close valve section of Flow-Wing by fitting center section of all-purpose wrench to valve stem in this manner. The valve opens and closes easily under full rated pressure.*

B *Using spanner end of same wrench make two turns on clamp screws to release bean.*

That is all. Replace bean, reverse operations and well is back on production. **C**

Here, in a single compact unit, are all essential fittings required for a Christmas tree wing: An easily operable valve, a positive choke, an efficient 2-bolt flowline union and a bleeder plug to release pressure trapped in the line. Note how the positive choke section of the unit is so easy to get to . . . no cage nipple, threaded or flanged connections, or bean wrenches are required for choke changing. This operation is fast, safe and simple.

These efficient Cameron Flow-Wings may be incorporated in any manufacturer's Christmas tree. They are as interchangeable as a valve, pressure gauge or any other fitting.

Cameron Flow-Wings are available in both low pressure threaded models and with API flanged connections in test pressures ranging up to 15,000 lbs. Complete details are carried in your Composite Catalog or literature will gladly be sent to interested operators on request.

CAMERON IRON WORKS, INC.

P. O. BOX 1212, HOUSTON, TEXAS

Export: 74 Trinity Place, New York, N. Y. Oklahoma: 310 Thompson Bldg., Tulsa (Telephone 28970). California: Long Beach (P. O. Box 267). Wyoming: 356 N. Wolcott St., Casper. North Louisiana: Bossier City (P. O. Box 425). Texas: Midland (Telephone 1982), Corpus Christi (Telephone 28783), Ft. Worth (Telephone 46522).